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ABSTRACT

A national random sample of over 14,000 high school seniors was studied with respect to socio-cultural differences in responses to cognitive test items. Six different cognitive tests and ten different groups were analyzed. The tests were: vocabulary, picture-number, reading, letter-groups, mathematics, and mosaic comparisons. The groups were: American Indians, Blacks, Mexican-Americans, Puerto Ricans, Other Latin-Americans, Oriental-Americans, White Northeastern, White North Central, White Southern, and White Western. Proportions of each group responding correctly to each item of each test were computed and then transformed to an interval scale of delta-values. The delta-values for the White North Central group were then cross-plotted with each of the other groups to yield an elliptical pattern of points for each comparison. The major axis of the ellipse for each cross-plot was determined and the distance of each item-point from it computed. These distances were used to create a vector index of cross-cultural stability. Items having notable patterns of instability were examined closely for factors which might explain such an outcome. The greatest instabilities were noted among the vocabulary items. These vocabulary instabilities appeared to be attributable to linguistic differences, primarily those existing between Spanish-speaking groups and other groups. Vocabulary items involving cognates were relatively easier for the Spanish-speaking groups. It was also observed that reading test items having material relevant to black culture was relatively easier for blacks than were other items in the test battery. (Author/MV)

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PR-74-2

THE CROSS-CULTURAL STABILITY OF MENTAL TEST ITEMS

An Investigation of Response Patterns for Ten Socio-Cultural Groups

ED137370

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EDUCATIONAL TESTING SERVICE
PRINCETON, NEW JERSEY

FINAL REPORT

The Cross-Cultural Stability of Mental Test Items: An Investigation of Response Patterns for Ten Socio-Cultural Groups

National Institute of Education Project No. 3-0658
(Grant No. NE-G-00-3-0116)

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Abstract

A national random sample of over 14,000 high school seniors was studied with respect to socio-cultural differences in responses to cognitive test items. Six different cognitive tests and ten different groups were analyzed. The tests were: vocabulary, picture-number, reading, letter-groups, mathematics, and mosaic comparisons. The groups were: American Indians, Blacks, Mexican-Americans, Puerto Ricans, Other Latin-Americans, Oriental-Americans, White Northeastern, White North Central, White Southern, and White Western. Proportions of each group responding correctly to each item of each test were computed and then transformed to an interval scale of delta-values. The delta-values for the White North Central group were then cross-plotted with each of the other groups to yield an elliptical pattern of points for each comparison. The major axis of the ellipse for each cross-plot was determined and the distance of each item-point from it computed. These distances were used to create a vector index of cross-cultural stability. Items having notable patterns of instability were examined closely for factors which might explain such an outcome.

The greatest instabilities were noted among the vocabulary items. These vocabulary instabilities appeared to be attributable to linguistic differences, primarily those existing between Spanish-speaking groups and other groups. Vocabulary items involving cognates were easier for the higher socio-economic status Spanish-speaking groups than for the White North Central group. It was also observed that reading test items having material relevant to black culture were relatively easier for blacks than were other items in the test battery. A perhaps significant

finding occurred in the analysis of mathematics items. The index computed revealed classes of items especially difficult for minorities and especially easy for minorities (relative to their performance on other portions of the test battery). Mathematical knowledge obtainable from everyday life situations, such as how to count money, were relatively less difficult for minority groups. In contrast, very simple mathematical problems, such as determining the value of square roots of whole numbers less than ten, seemed extraordinarily difficult for minority groups. Since such knowledge, though easily obtained, is usually only obtained in a school setting, what is suggested is that most minority groups in the United States receive seriously deficient schooling in mathematics.

Preface

The research reported in this paper was supported in its entirety by a Small Grant from the National Institute of Education's Field Initiated Studies Program. Because of the limited funding associated with these Small Grants the studies themselves must be of a limited nature. The present study is only an exploration into the complex problem of testing in a pluralistic society. Rather than being a comprehensive analysis, the study is intended merely to suggest a new way of thinking about test use and construction. While the data used for the study have the potential for much more exhaustive analysis, such exhaustive analysis was not possible.

Acknowledgements

Since the work reported in this paper was a spin-off from a much larger effort, it owes a great debt to the previous work. That previous work was the Base Year Survey of the National Longitudinal Study of the High School Class of 1972. This survey was conducted by the Educational Testing Service for the United States Office of Education. The principal investigator of the survey, Thomas L. Hilton, was therefore an important contributor to the present study as were a number of others at the Educational Testing Service. Parts of the final report for this previous work have been used liberally and some of the appendices taken intact.

The following individuals provided leads and advice on at least one occasion: William H. Angoff, Clair Bowman, Joel T. Campbell, Ronald L. Flaugher, Robert L. Linn, and Elizabeth Stewart. The responsibility for the final direction the study took, however, rests entirely with the principal investigator.

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Introduction

There is a conviction among many members of ethnic minority groups and others that traditional tests of academic achievement and tests used for employment decisions are biased in favor of a white middle-class culture. Although much research tends to discount such a belief (e.g., Stanley, 1971; Cleary, 1968; Rock, 1970; Campbell, Crooks, Mahoney, and Rock, 1973), there is no doubt that some items on some tests are more difficult for some socio-cultural groups. This point was emphasized by Green and Draper (1972):

> As a matter of fact we do know that most academic tests, both aptitude and achievement, yield consistently higher scores for one set of groups in society in contrast to various other groups such as poor people, blacks, and Chicanos (Coleman, 1966). Some people overgeneralize these results to indicate that the latter groups are inferior to the former. In so doing they are assuming the tests are fair and unbiased. [p. 5]

What the words "fair" and "unbiased" mean, however, has proven to be difficult to define. Green and Draper note:

> A biased test is popularly understood to be a test which is unfair to identifiable subgroups of the general population in which it is being used. Although many people seem to believe the matter is simple, little is actually known about the nature of bias in tests and even the most widely accepted propositions badly need verification. [p. 1]

This kind of confusion led Darlington (1971) to propose that the concept of "cultural fairness" be replaced by a concept of "cultural optimality." No terminology, however, replaces the need for a careful consideration of the way in which a specific test (or portion thereof) is used. In the words of Thorndike (1971):

> Since there are many different uses that can be made of a particular test or inferences that can be based upon it, it is entirely possible that one use or inference is fair while another is grossly unfair. [p. 63]

As an example of unfair test use, Thorndike presented the following hypothetical item:

The usual temperature for baking a cake is about:

(A) 250° (B) 300° (C) 350° (D) 400°

In terms of the proportion of correct responses that would probably be obtained were such an item administered, the item would seem unfair to males, since they spend less time cooking than do females. Thus, if this item were used as part of a college admissions test, it would clearly seem inappropriate. But if it were used as part of a test to select persons for employment as bakers, then the item would at least have face validity.

Rather than considering individual items, the more common approach has been to consider entire tests. Attempted statistical definitions of test bias have been approached by two basically different methods: those using criteria external to the test, and those using only internal criteria (Potthoff, 1972). Methods employing external criteria generally involve use of test scores for prediction of some future success. Cleary (1968) has provided a widely accepted definition of test bias which compares regression equations of test scores on criterion for different groups. She states:

> A test is biased for members of a subgroup of the population if, in the prediction of a criterion for which test was designed, consistent nonzero errors of prediction are made for members of the subgroup. In other words, the test is biased if the criterion score predicted from the common regression line is consistently too high or too low for members of the subgroup. With this definition of bias, there may be a connotation of "unfair," particularly if the use of the test produces a prediction that is too low.

Thorndike (1971) demonstrated that a test which would be fair by Cleary's definition may be unfair by another standard. He has shown that when mean differences between two groups on the predictor are large relative to mean differences on the criterion, even when regression lines for the two groups are equal, the test would select a smaller proportion of the low scoring

group than the proportion who actually could have been successful on the criterion. According to Thorndike (1971) a fair test must select a proportion of the minority group which is equal to the proportion who would actually succeed on the criterion. This may necessitate the lowering of critical cut-off points for selection for some minority groups.

Cole (1972) approaches test bias by examining decision errors for various groups. The proportion of false positives (those with acceptable predictor scores and unacceptable criterion scores) to false negatives (those with unacceptable predictor scores and successful criterion scores) should be the same in all groups if the test is "fair."

Comparative studies of these and other definitions of test bias (Linn, 1973; Darlington, 1971) show that the previously mentioned approaches are contradictory. The enigmas encountered in the external criterion approach have been clarified somewhat by Reilly (1973). A test which may be fair by one definition may be unfair by another. Therefore, a single statistical solution to the problem of test bias derived from the comparison of tests to an external criterion seems impossible. Considering that the external criterion, itself, may be biased (see Campbell, et al.,1973) leads one to question this entire approach. Both Darlington (1971) and Linn (1973) conclude that statistical solutions alone are not sufficient to solve the test bias problem--some value judgments must be made. Darlington proposes the concept of the "culturally optimal test" which balances cultural differentiation with validity and which employs both subjective policy level decisions and empirical statistical information.

An alternate approach to the definition of cultural bias attempts to make some statistical statement about the items in a test without

information other than that obtainable from the test items themselves. The methods used by Cleary and Hilton (1968), Echternacht (1972a, 1972b), Angoff and Ford (1973), Angoff (1972), Angoff and Modu (1973), and Cardall and Coffman (1964) essentially compare item difficulties across cultural groups. Those items which are either unusually easy or unusually difficult for one group in relation to another group are examined. If many items are unusual across several group comparisons, the test may be called biased. While these studies are labeled studies of "item bias," they rarely attempt to analyze sources of deviation for outstanding items. The attempt has been usually to make some inference about the test as a whole by demonstrating the existence or lack of existence of a significant item--group interaction. Individual items are not considered in a subjective sense nor are the possible sources of bias in any one individual item explored with any depth.

Those few papers that do consider individual items most often attempt to define some mechanical procedure with which "biased items" may be detected. Given the importance of the use to which items (or entire tests) are put, no entirely mechanical procedure would seem likely to gain acceptance. It is the objective of the present study to explore the problem of cross-cultural stability of test items with a combined mechanical and subjective approach in much the same way as Darlington combined the mechanical and subjective in thinking about entire tests. The procedure is, first, to compute an index (mechanically, which is useful in detecting especially unstable items and then to apply subjective analyses to determine what, if anything, characterizes these items. Similarly, items may also be detected because of their apparent stability. Subjective judgments are then used to characterize these items.

The procedure used is similar to that used by Angoff and Ford (1971). They compared several samples of black and white students drawn from the 1970 PSAT (Preliminary Scholastic Aptitude Test) administration in Georgia. Item analyses were conducted for each sample and item difficulty cross-plotted for pairs of samples. As a measure of item x group interaction, they used the correlation of item difficulties (the lower the correlation, the more the interaction). Angoff and Ford concluded that the findings were sufficiently provocative to deserve more detailed study. Like the cross-plots of Cleary and Hilton, those of Angoff and Ford also indicated a number of items that appeared to be especially difficult for blacks. Angoff and Ford suggested a need for studies with larger samples than those they had used. This remark of theirs is of special interest:

> Further editorial examination of the items that were especially harder for the blacks suggested, as one would expect, particular difficulties with vocabulary and concepts pertaining to unfamiliar places and experiences, and possibly also to confusion with special meanings and significances characteristic of the ghetto.

The same kinds of phenomena were discussed by Taylor (1971) in an entirely different context (that of speech difficulties) and from a different disciplinary viewpoint (socio-linguistics). Deemphasizing the importance of the ghetto, Taylor traced the evolutionary history of Black English and showed how, because of a different long-term cultural development, Black English is very different from what is sometimes called Standard English. The position of Taylor is important in that it challenges the so-called social deprivation theory (that blacks simply have underdeveloped language and cognitive abilities) by emphasizing that Black English (implying a language more deeply rooted than "hip talk") is very different from Standard English. Taylor also indicated that there are probably several types of English among whites

living in the continental United States. Southern White English has strong similarities to Black English; however, Standard English is very different from either Black English or Southern White English. Since it is well known that white southerners also tend to score low on standard achievement tests, this observation of Taylor is especially noteworthy.

If strong differences exist between Black English and Standard English, and even among different types of American English, then the linguistic patterns of American Indians, Mexican-Americans, Puerto Ricans, and Oriental-Americans might be expected to differ as well. Armstrong (1972) had members of several ethnic groups rate test items as to the degree they believed them to be biased against their group. Within ethnic groups, he found surprising agreement on which items were biased. But the items considered to be biased varied considerably from one ethnic group to another. Accordingly, Armstrong's research would support Taylor's theory. Armstrong, however, conducted no analyses of data from test administrations for these different ethnic groups.

A recently collected, and extensive, set of data has afforded the opportunity for conducting the present study. These data are those from the National Longitudinal Study of the High School Class of 1972.[1] In this sample of over 17,000 high school students, special attention was paid to the problem of insufficient numbers of cases for minorities so that adequate data were obtained for analyses relating to minorities. With such a large number of cases and detailed classifications by ethnic group, region, and other identifying criteria, these data are ideal for the study of the problem of cross-cultural stability of test items. The cognitive tests used in the

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[1]Conducted for the U.S. Office of Education by the Educational Testing Service under Contract No. EC-0-72-0903

National Longitudinal Study (NLS) cover a range of abilities and item presentation styles. Moreover, the care with which the sample was taken offers the potentiality of generalization to the nation as a whole.

An exploratory development of a procedure for computing an index of cross-cultural stability was conducted. Some characteristics of items so detected, obtained from a subjective analyses of the items, are presented. The possibility of using the same technique, cumulatively, to describe entire tests with respect to their cross-cultural stability is also considered. Beyond a brief consideration of the causal factors underlying the item instabilities presented, a need exists for generalizations about these causal factors. It is believed that these generalizations are best attempted by those who belong to the specific socio-cultural group to which the instabilities relate or by those, such as socio-linguists, who have studied such problems. Accordingly, it is hoped that the ethnic scholars and others to whom this report is being disseminated will attempt these generalizations.

The Sample

The data used in the project were recently collected as a part of the NLS. This study was based on a stratified two-stage probability sample. Schools were selected nationwide, with known probabilities, by WESTAT Corporation, from universe listings of schools retained by the U. S. Office of Education. The population was stratified by a set of eight variables: (1) public or nonpublic, (2) geographic region, (3) enrollment size class, (4) proximity to institutions of higher education, (5) percent minority, (6) income level of the community around the school, (7) school type--where Type A represented schools of low income or high minority classification, and Type B represented all others--and (8) degree of urbanization. Altogether, 600 final strata were defined and Type A schools were selected at twice the sampling rate of Type B schools to produce a final sample of 1,200 schools, two from each final stratum.

Within each cooperating sample school, a random sample of students in grade 12 (or its equivalent) was taken by Educational Testing Service from lists of all such students provided by the school. Where possible, 18 students were selected. Occasionally, noncooperating students or small school enrollments resulted in fewer than 18 students being included in the final sample.

A few kinds of schools and students were excluded from the study. Excluded schools consisted mostly of schools for physically or mentally handicapped students, schools for legally confined students, and schools which did not enroll students of their own (such as area vocational schools having students enrolled in other schools). Included schools were required to be within the 50 states and the District of Columbia. Excluded students

consisted of early graduates, adult education students, and students who in the view of their school would be harmed by participating in the study. The final count of students involved in the study was 17,726, and these represented 1,044 different high schools of the targeted sample of 1200 schools.

Instruments

The instruments examined were those used in the National Longitudinal Study Sample. A sample of item-types from the battery and the answer sheet used in responding are included as Appendix A. Further details of procedures used are provided through the Survey Administrators Guide , Appendix B (giving the procedures used in administering the test). The sequential order of the tests, described in detail below, was: Vocabulary, Picture-Number, Reading, Letter Groups, Mathematics, and Mosaic Comparisons. This sequence was chosen because it interspersed the three more conventional and the three more novel tests, an arrangement that provides interest and motivation for the examinees. Vocabulary was chosen for the first position because of the inherent simplicity of this test's format and directions. At the outset, it was believed that the Vocabulary Test should build the confidence of the students in their capability to perform well. Because it is quite speeded, Mosaic Comparisons was placed last to prevent any anxiety that might be engendered by this speededness from persisting in later test sections.

The composition of the NLS battery represented a balancing of somewhat opposing considerations. The primary objective was to obtain a comprehensive description of persons whose backgrounds, ethnic affiliations, and socio-economic status are quite diverse. At the same time, the need for various measures had to be balanced with the requirement of using a battery of reasonable length. Lengthy tests are a nuisance to schools that must schedule time to administer them and to students who must endure them without significant fatigue or loss of interest. For this reason, the battery was held to 69 minutes of testing time plus 36 minutes of

Table 1

NLS Test Battery Properties

Test	Time in minutes	Number of items	Number of options	Scoring formula	Formula scores		Speededness			Reliability	Standard error of Measurement	Statistics based on: Sample	n
					Mean	Standard deviation	Percent of items completed	Percent of sample Completing 75% of items	Item Reached by 80% of sample				
Vocabulary	5	15	5	R-W/4	7.82	3.64	90	[illegible]	15	.70	2.0	Students tested in April, 1969, before their entry to two-year colleges	2,765
Picture Number	10	30	10	R-W/9	18.4	7.61	77	99	29	.85	3.0	Students tested in April, 1969, before their entry to two-year colleges	2,710
Reading	15	20	5	R-W/4	9.0	4.0				.70	2.2		
Letter Groups	15	25	5	R-W/4	16.2	5.10	44	90	21	.80	2.3	Students tested in April, 1969, before their entry to two-year colleges	2,780
Mathematics	15	25	4	R-W/3	13.0	4.2				.70	2.3		
Mosaic Comp.	9	116			43.5	14.9				.7[illegible]		Students tested in 1968, before their entry to two-year colleges	1,740
Section I	(3)	56	3	R-W/2	(19.7)	7.6	1	2	16				
Section II	(3)	33	4	R-W/3	(13.7)	5.3	1	4	12				
Section III	(3)	27	5	R-W/4	(10.1)	4.5	1	5	9				
	69												

administrative time for a total of 105 minutes. Table 1 provides a summary of the properties of the battery.

An ETS optical scanning system (SCRIBE) was used in processing the test answers, which students entered on a separate answer sheet (Appendix A). This process thus maintained a uniform procedure with previous use of the test components, rather than introducing another process variable by having students indicate answers by some other procedure, such as circling or directly marking answers in test books.

To conserve testing time, some of the tests used in the NLS battery were shorter than the parent versions from which they were derived. The tests were originally designed to yield reliability coefficients appropriate for use with individual students. However, the tests used in NLS were not intended for making decisions about individuals; rather, they were used as group measures, wherein the reliability of the mean scores for various samples or subgroups was the critical consideration. In such situations, the error variance of a mean is only $1/N^{th}$ the error variance associated with an individual score. Thus, the tests in the battery, with estimated reliabilities ranging from .70 to .85, yield highly reliable measurements of the mean. A brief description of each test section and a summary of its psychometric properties follows.

Vocabulary. A brief test using synonym format consisting of items drawn from the longer Project Access Vocabulary Test. The 15 items selected were intended to avoid academic or collegiate bias and to be of an appropriate level of difficulty for the NLS twelfth grade population. Verbal ability is known to be related to performance in most academic pursuits as well as professional and semiprofessional occupations. The straightforward vocabulary synonym test is the best and most well-documented

measure of this verbal ability. Evidence for the predictive validity of the Vocabulary Test is given in Table 2. Median correlations between Vocabulary Test scores and first-term grade-point averages of students enrolled in various curriculums within two-year community colleges are in the range of .2 to .4. The Vocabulary Test has also been related to subsequent performance in specific entry-level English courses at community colleges (Ford, 1970). The median correlation represented between the Vocabulary Test and freshman English courses within 38 community colleges was .26 with a range of validity of .08 to .40, depending upon the specific college considered.

Picture-Number. Consists of a series of drawings of familiar objects, each paired with a number. The student, after studying the picture-number pairs, is asked to recall the number associated with each object. This test appeared in both the CGP and Project Access batteries. The inclusion of the Picture-Number Test represents acknowledgment of a line of research that suggests that populations low in economic status have relatively higher mean scores in associative memory than in other types of ability (Semler & Iscoe, 1963; Rohwer, et al., 1968; Jensen, 1969). Further, recent theoretical developments would suggest that such abilities can be utilized in increasing the school achievement of this same group (Rohwer, 1971). Predictive validity information is not currently available. However, the test does have face validity based on the references cited above.

Reading. Based on short passages (100-200 words) with several related questions concerning a variety of reading skills (analysis, interpretation) but focusing on straightforward comprehension. The Reading Test draws upon items of particular relevance to minority group students taken from the

Table 2

Median Correlations of Parent Tests of NLS Battery with Freshman Grade Averages Obtained in Various Community College Curricula*

--Median correlations of CGP tests with freshman grade averages obtained in various community college curricula*

		College parallel				Occupational-technical					Occupational-vocational					
Tests		Lib. arts	Sci. & pre-eng.	Fine arts	Agric.	Sci. & eng.	Business	Health	Comm. arts	Other	Mech.	Business	Health	Art skills	General/ devel.	Unclas.
Reading	Median r	.32	.29	.21		.31	.36	.39		.33	.14	.14	.31		.25	.20
	# Groups	27	15	5	2	16	24	7	2	6	4	3	3	1	3	11
	Range Low	.13	-.10	.13	.37	.05	-.02	.01	.22	.10	.07	.02	.31	-.04	.17	-.19
	Range High	.70	.49	.43	.61	.52	.52	.63	.36	.45	.44	.46	.47		.26	.36
	# Sig. r's[a]	23/0	8/0	1/0	2/0	8/0	21/0	5/0	1/0	4/0	1/0	1/0	2/0	0/0	1/0	4/0
Vocabulary	Median r	.34	.24	.23		.22	.32	.42		.33	.16	.31	.30		.18	.23
	# Groups	27	15	5	2	16	24	7	2	6	4	3	3	1	3	11
	Range Low	.05	-.18	.08	.42	-.20	-.18	.33	.02	.18	.10	.16	.21	.02	.10	-.08
	Range High	.61	.49	.27	.44	.48	.55	.69	.47	.44	.26	.52	.50		.29	.38
	# Sig. r's[a]	24/0	7/0	0/0	2/0	7/0	17/0	5/0	1/0	3/0	1/0	1/0	2/0	0/0	1/0	4/0
Mathematics	Median r	.25	.25	.24		.41	.26	.33		.28	.24	.40	.24		.11	.14
	# Groups	27	15	5	2	16	24	7	2	6	4	3	3	1	3	11
	Range Low	-.03	.07	.10	.16	.06	.01	-.13	.09	.23	.17	.03	.06	.03	.04	-.29
	Range High	.58	.66	.44	.68	.59	.51	.61	.17	.46	.46	.50	.36		.26	.34
	# Sig. r's[a]	15/0	9/0	1/0	1/0	11/0	14/0	4/0	0/0	3/0	4/0	2/0	1/0	0/0	1/0	4/0
Letter Groups	Median r	.23	.24	.11		.14	.37									.01
	# Groups	13	6	3	1	5	11	2	0	1	1	1	1	0	1	5
	Range Low	.08	-.03	.08	-.06	-.18	.04	-.10		.32	.24	.36	.18		.07	-.29
	Range High	.65	.33	.46		.21	.53	.23								.43
	# Sig. r's[a]	8/0	2/0	1/0	0/0	0/0	9/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	1/0

[a] Number of correlations above .20 and significant at .05 level:

x/y
x = number significant and positive
y = number significant and negative

Source: Hilton & Rhett (1973)

* Data from 1967-68 academic year

Project Access Reading Test. The Reading Test was included because it is a direct measure of skill used widely throughout the educational system and thus has good face validity and widely-recognized importance. The pattern of validity coefficients for the Reading Test against the criterion of freshman grade average is, as would be expected, similar to that for vocabulary (Table 2).

Letter Groups. This test requires the student to draw general concepts from sets of data or to form and try out hypotheses in a nonverbal context. The items consist of five groups of letters among which four groups share a common characteristic while the fifth group is different. The student indicates which group differs from the others. As a test of inductive reasoning, the test measures one of the four aptitudes (verbal, quantitative, reasoning, and spatial/perceptual) which have considerable precedent in representing the varieties of cognitive skills. Tests of inductive reasoning have, in particular, been shown to be useful in research involving minority ethnic groups (Lesser, Fifer, & Clark, 1965; Stodolsky & Lesser, 1967; Flaugher, 1971). This test, in combination with the Mathematics Test that was included in the battery, provided a measure of the reasoning capacity of students. Unlike the Mathematics Test, however, the Letter Groups Test seems to be less dependent on knowledge obtained in a formal education setting; thus, it may offer an opportunity for inner-city and minority group students who come from poor educational backgrounds to demonstrate their reasoning abilities without regard for the lack of educational and mathematical training they may have had. The predictive validity for the Letter Groups Test is particularly good for predicting performance in courses involving business and office-related occupational training. A median correlation of .37 among 11

community colleges was found between the Letter Groups Test and freshman grade performance in occupational-technical programs in business (Table 2).

Mathematics. Consists of quantitative comparisons in which the student indicates whether two quantities are unequal (and which is greater), equal or not ascertainable from the information given. This type of item is relatively quickly answered and provides measurement of basic competence in mathematics while minimizing the amount of time required for actual computation. The test is a shortened version of widely used instruments but omits those items that tap algebraic, geometric, or trigonometric skills. The parent test from which the NLS Mathematics Test was derived shows potency in predicting community college course grades (Ford, 1970). In addition, the predictive validity of the SAT (Scholastic Aptitude Test) and mathematics scores in the NLS battery may be linked, as has been thoroughly documented (Angoff, 1971).

Mosaic Comparisons. Measures perceptual speed and accuracy through items which require that small differences be detected between pairs of otherwise identical mosaics or tile-like patterns. A deliberately speeded test, it has three separately timed sections consisting of increasingly more complex mosaic patterns. Mosaic Comparisons represents another of the fundamental measures used in many studies of aptitudes among minority groups. Tests like this which represent the spatial/perceptual domain seem, more than tests in the other domains considered, to allow students from minority groups an opportunity to perform better than they might otherwise. The Mosaic Comparisons Test, unlike many other spatial/perceptual scanning measures, is simple for the student to understand. Its predictive validities with performance in occupational-technical two-year career and one-year career business programs at the community college level were .28 and .42

respectively. These correlations represent median values across a number of different colleges. In addition to predictive validity in the career business area, the Mosaic Comparisons Test has shown a median correlation of .23 with the freshman grade performance of students enrolled in college-parallel fine arts curriculum.

Method

The sample was first divided into ten mutually exclusive groupings as follows:

1. American Indian
2. Black or Afro-American or Negro
3. Mexican-American or Chicano
4. Puerto Rican
5. Other Latin-American or of Spanish Origin
6. Oriental or Asian-American
7. Northeastern White or Caucasian
8. Southern White or Caucasian
9. North Central White or Caucasian
10. Western White or Caucasian

Item analyses were then conducted for each group of subjects so defined. The item analyses were performed using a procedure outlined by Angoff & Ford (1973). In this procedure, the proportion of a sample or sub-sample answering a given item correctly (known as the "p-value") is first calculated. The p-values are then transformed to an interval scale by replacing them with their normal-curve equivalents (called normal deviates). Because the normal deviates have a range from -1 to +1, these are often subjected to a further transformation so as to eliminate negative values. In the Angoff and Ford procedure, the normal deviates are transformed to delta-values by the linear transformation, $\Delta = 4z + 13$.

It should be noted that item difficulties computed by the above procedure ignore what are, at times, important factors. One factor ignored is that related to the position of an item in a test. Items occurring near the end

of a test will have fewer correct responses merely because fewer examinees attempted them. The greater the importance of time in the test (i.e., the higher the "speededness" of the test), the greater the importance of this item position factor. In the test battery used for the National Longitudinal Study only the Mosaic Comparisons Test is highly speeded. For this reason, only the first 20 items of the second of three parts of the Mosaic Comparisons Test were used in the analysis. No item analysis procedure, however, precludes the necessity of subjective information with which to judge the validity of the statistical computations. Accordingly, item analyses reported in this study are accompanied by descriptive information concerning the item, including its position in the test or subtest, the proportion of persons for each group answering the item, and the item itself, where test security limitations permit.

Having computed the item deltas for each item and for each of the ten mutually exclusive groups given above, the next step in the procedure was to cross-plot the deltas for nine of the groups in contrast to a tenth group (North Central White or Caucasian). For each cross-plot, the group being examined was placed on the abscissa and the delta values for the North Central White group on the ordinate. These cross-plots normally result in a narrow elliptical pattern with the major axis extending from the lower left to the upper right, very much in the same way as scatter-plots of predictive single observations used in correlational analysis. One should note, however, that the points in the cross-plots under discussion represent large numbers of observations (each point represents <u>two</u> delta values and each delta value was determined from the total of all encounters with the item by the group it represents). Thus it is not unusual to find that when a

correlational analysis is performed on points so derived, that the correlational values obtained are typically as high as .98 or .99. Where the two groups being compared are very different the correlations will not be quite so high. In the present analysis, the line of best fit used was the major axis of the elliptical patterns of points rather than the regression line usually involved in correlational analysis.

An important feature of the major axis is that it indicates the general degree of difficulty of all items taken together for a given group. If all items, on the average, are of equal difficulty for both groups being contrasted, then the major axis will have a slope of 1.0 and an intercept (projected) of zero. If the items in general (that is, the whole test) are more difficult for the group plotted on the abscissa, then the regression line will have an intercept less than zero. And if a test is easier for the group whose delta values are plotted on the abscissa, the intercept will be greater than zero. The slopes of these more and less difficult lines may be different from 1.0.

Cross-culturally unstable items are those with the most aberrancy around the line of best fit for a particular group. Using the symbols x and y to represent the delta values for two groups being contrasted and using the slope-intercept form of representation for a straight line, $y = ax + b$,

$$a = \frac{(s_y^2 - s_x^2) \pm \sqrt{(s_y^2 - s_x^2) + 4r_{xy}^2 s_x^2 s_y^2}}{2r_{xy}s_x s_y}$$

and $b = M_y - aM_x$. With these relationships from Angoff & Ford (1973), the major axis of the ellipse representing any contrast is defined. The

symbols M and s above represent the mean and standard deviation, respectively, r the correlation between the deltas for the two groups, and the subscripts x and y the abscissal and ordinal coordinates. The perpendicular distance, d_i, of each point, i, in the cross-plot to this major axis is given as

$$d_i = \frac{ax_i - y_i + b}{\sqrt{a^2 + 1}}$$

When $d_i = 0$ for a particular item, then the item is perfectly stable with respect to the two groups being contrasted. When $d_i > 0$, the item tends to be more difficult for the group on the ordinate than were most other items of the same test for the same group. Such an item would be said to be positively unstable. If $d_i < 0$, then the item tends to be more difficult for the group on the abscissa than were most other items of the same test for the same group.

Classification Variables

Classification variables were used to categorize participants as well as to indicate fundamental differences among groups being compared. These variables were obtained from NLS survey questionnaires as follows:

Sex. Sex of participants was obtained from the NLS Student Questionnaire. Those survey students who did not respond to this item or did not return a Student Questionnaire could not, of course, be classified with respect to sex.

Ethnicity. The ethnicity of participants was obtained from item 84 of the NLS Student Questionnaire (reproduced below). All participants who omitted the item or did not return the Student Questionnaire or did not take the NLS test battery were excluded from the study.

84. How do you describe yourself?

	(Circle one.)
American Indian	1
Black or Afro-American or Negro	2
Mexican-American or Chicano	3
Puerto Rican	4
Other Latin-American origin	5
Oriental or Asian-American	6
White or Caucasian	7
Other	8

Language Spoken in Home. The language spoken most often in the home (English or not English) was obtained from item 88 of the NLS Student Questionnaire as indicated below.

88. Is English the language spoken most often in your home?

	(Circle one.)
No	1
Yes	2

Time in Community. Time in community was obtained from item 89 of the NLS Student Questionnaire as indicated below.

89. How long have you lived in the community in which you now live?

(Circle one.)

All my life	1
Ten or more years	2
Five to ten years	3
Three to four years	4
One to two years	5
Less than one year	6

Parents' Educational Level. Father's education and mother's education was obtained from item 90 of the NLS Student Questionnaire, duplicated below.

90. What was the highest educational level each of the following persons completed? If you are not sure, please give your best guess.

(Circle one number in each column.)

	Father or male guardian	Mother or female guardian	Oldest brother or sister
Doesn't apply	1	1	1
Did not complete high (secondary) school	2	2	2
Finished high school or equivalent	3	3	3
Adult education program	4	4	4
Business or trade school	5	5	5
Some college	6	6	6
Finished college (four years)	7	7	7
Attended graduate or professional school (for example, law or medical school), but did not attain a graduate or professional degree	8	8	8
Obtained a graduate or professional degree (for example, M.A., Ph.D., or M.D.)	9	9	9

Parents' Income. Parents' income was obtained from item 93 of the NLS Student Questionnaire as indicated below.

93. What is the approximate income before taxes of your parents (or guardian)? Include taxable and non-taxable income from all sources.

(Circle one.)

Less than $3,000 a year (about $60 a week or less)	01
Between $3,000 and $5,999 a year (from $60 to $119 a week)	02
Between $6,000 and $7,499 a year (from $120 to $149 a week)	03
Between $7,500 and $8,999 a year (from $150 to $179 a week)	04
Between $9,000 and $10,499 a year (from $180 to $209 a week)	05
Between $10,500 and $11,999 a year (from $210 to $239 a week)	06
Between $12,000 and $13,499 a year (from $240 to $269 a week)	07
Between $13,500 and $14,999 a year (from $270 to $299 a week)	08
Between $15,000 and $18,000 a year (from $300 to $359 a week)	09
Over $18,000 a year (about $360 a week or more)	10

Community Size. School community size was obtained from item 40 of the NLS School Questionnaire. This item, duplicated below, was completed by the NLS Survey Administrators in the schools participating in the NLS.

40. Which of the following best describes the location of this school?

(Circle one.)

In a rural or farming community	1
In a small city or town of fewer than 50,000 people that is not a suburb of a larger place	2
In a medium-sized city (50,000–100,000 people)	3
In a suburb of a medium-sized city	4
In a large city (100,000–500,000 people)	5
In a suburb of a large city	6
In a very large city (over 500,000 people)	7
In a suburb of a very large city	8

Geographic Classifications. The four geographic divisions of the United States, as defined by WESTAT Corporation, were used. The states included in each division were as follows:

(1) Northeast (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, and Pennsylvania).

(2) North Central (Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas).

(3) South (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, and Texas).

(4) West (Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Washington, Oregon, California, Alaska, and Hawaii).

Sample-Description by Groups

The original sample of 17,726 cases was reduced to 14,828 cases by the requirement that each case to be analyzed have both an NLS Student Questionnaire and an NLS Student Test Book answer sheet. The distribution of these cases by socio-cultural group, sex, and primary language spoken in the nome (English or other) is given in Table 3. For a few of the cases there was no response to the sex and language spoken questions and for this reason the figures do not add to the totals in Table 3. Within the groups, the distribution of males and females appears to be relatively uniform. Major differences occur, however, with regard to language spoken in the home. More Puerto Ricans (39) said that English was not the primary language spoken in the home than said that it was (38). A very large proportion of Other Latins (48) reported that English was not the primary language spoken in the home as compared to those who said that it was (56). The same was the case for Mexican-Americans (214 not English vs. 262 English). For the other groups, only small proportions said that English was not the primary language spoken in the home.

Table 4 shows summary data (means and standard deviations) for socioeconomic variables, degree of urbanization, and time in community for all groups and the total. The White Western group reported the highest mean father's education and the Mexican-American group the lowest. The same contrast occurred with respect to mother's education with White Western highest and Mexican-American lowest. For parents' income, however, Puerto Ricans were lowest. School community size

Table 3

Distribution of Cases by Socio-Cultural Group

Groups	Males	Females	Home Language		Total
			Not English	Primarily English	
American Indian	91	85	24	151	178
Afro-American	826	1,051	157	1,720	1,895
Mexican-American	251	235	214	263	491
Puerto Rican	39	40	39	38	79
Other Latin	49	56	48	56	107
Oriental	93	82	52	122	176
White Northeastern	1,278	1,499	189	2,603	2,798
White North Central	1,848	1,717	224	3,356	3,589
White Southern	1,793	1,740	230	3,319	3,557
White Western	1,023	921	111	1,843	1,958
Total	7,291	7,426	1,288	13,471	14,828

Table 4

Summary Data on Socio-Economic Variables,
Degree of Urbanization, and Time in Community

Group	Father's Education	Mother's Education	Parents' Income	School Community Size	Time in Community [a]
			Means		
American Indian	3.02	2.94	4.92	3.24	2.27
Black	2.87	3.18	3.17	4.26	2.44
Mexican-American	2.56	2.45	3.57	3.57	1.94
Puerto Rican	2.58	2.56	2.85	6.41	2.79
Other Latin American	3.82	3.50	4.45	5.23	2.94
Oriental	4.23	3.80	5.89	4.00	2.49
White Northeastern	4.10	3.71	6.15	3.86	1.95
White North Central	3.98	3.72	5.94	3.41	1.96
White Southern	4.06	3.68	5.69	3.39	2.26
White Western	4.61	4.10	6.40	3.90	2.39
Total	3.94	3.65	5.50	3.70	2.17
			Standard Deviations		
American Indian	1.85	1.56	2.90	2.29	1.36
Black	1.68	1.73	2.37	2.32	1.53
Mexican-American	1.55	1.28	2.47	2.36	1.28
Puerto Rican	1.39	1.42	1.61	1.51	1.56
Other Latin American	2.30	1.85	2.75	2.27	1.58
Oriental	2.26	1.99	2.90	2.33	1.39
White Northeastern	2.22	1.88	2.73	2.24	1.26
White North Central	2.21	1.82	2.70	2.46	1.28
White Southern	2.33	1.91	2.89	2.33	1.44
White Western	2.32	1.95	2.72	2.39	1.37
Total	2.25	1.88	2.91	2.38	1.39

[a]Note that this scale is reversed--a low value indicates a long time in the community (see page 23)

While these groups differ considerably on variables such as SES which are well known to be related to test performance, no adjustments are made for these differences in the present study. Since each of the socio-cultural groups were selected by a carefully conducted random sampling, these group differences are considered to be representative of cultural differences. From this point of view, no adjustments are appropriate.

Results

Cross-plots of all item deltas for each socio-cultural group, in contrast to the White North Central group, are shown in Figures 1 through 9. A dotted line has been drawn in each figure at 45 degrees to serve as a reference. Items falling on or near this line are of approximately equal difficulty for the White North Central group and the group to which it is being compared. The solid line passing through the center of the cluster of item points (+'s) is the major axis of the ellipse represented by these points. If the solid line falls below the dotted line it indicates that the battery as a whole was more difficult for the group whose delta-values are plotted on the abcissa. In Figure 1, for example, the position of the solid line relative to the dotted line indicates that the battery was more difficult for American Indians than for the White North Central group. Conversely, Figures 6 and 7 suggest that the battery was slightly easier for Oriental-Americans and for the White Northeastern group.

The results of primary interest, however, are not those related to the comparative difficulty of the battery as a whole. Rather, the focus of the present study is on specific items--especially those where the distance between the item-point (+'s) and the solid line is substantial. A number of such points may be noted from Figures 1 through 9. To provide a more convenient means for identifying specific items and for comparing them across groups, tables of values of d_i were prepared (Table 5 through 10). In these computer-generated tables, the d_i's are termed D-Values. The six tables correspond, respectively, to the six tests of National

Figure 1

Cross-plot of Deltas for American Indian

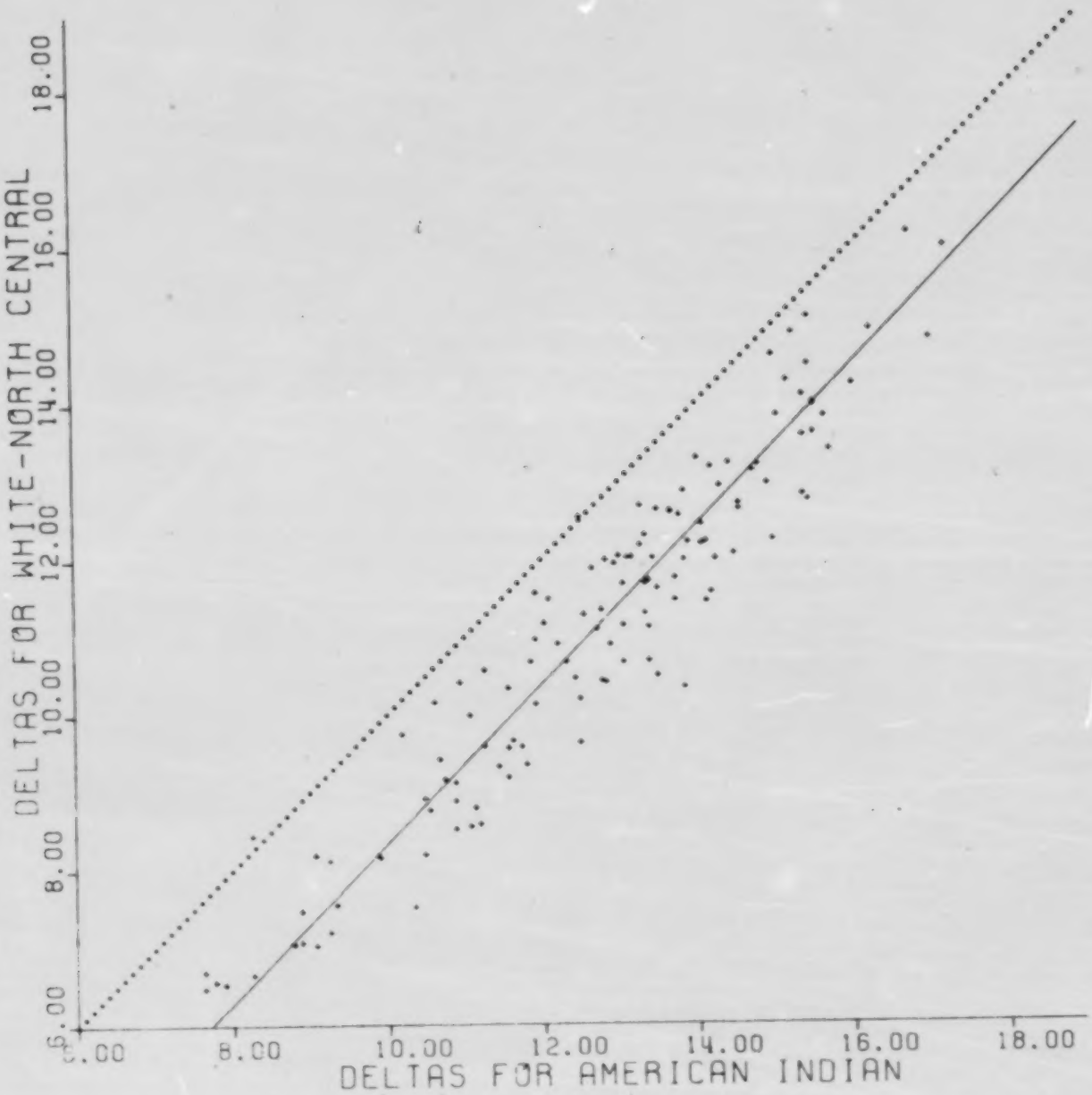

Figure 2

Cross-plot of Deltas for Afro-American

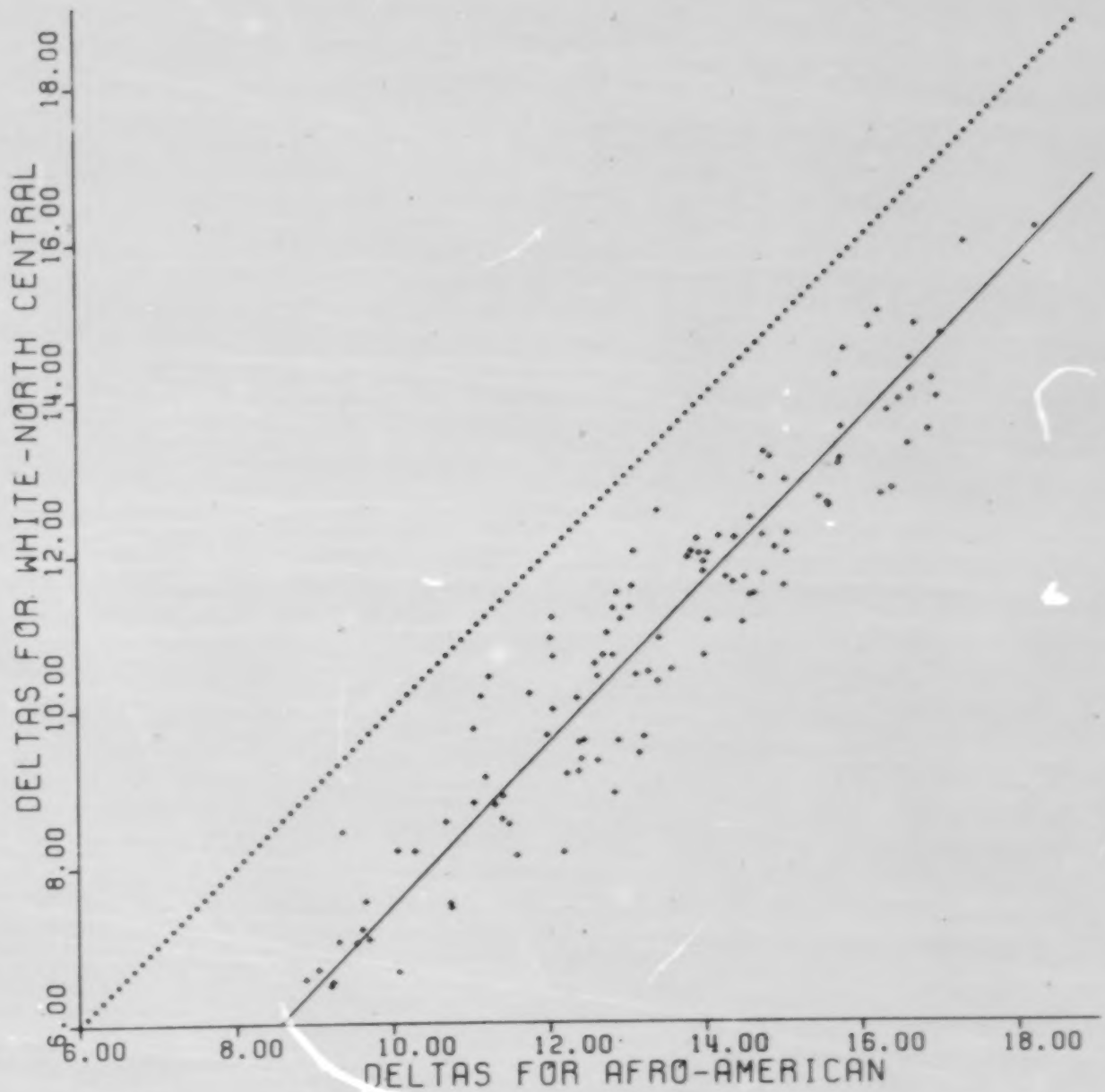

Figure 3

Cross-plot of Deltas for Puerto Rican

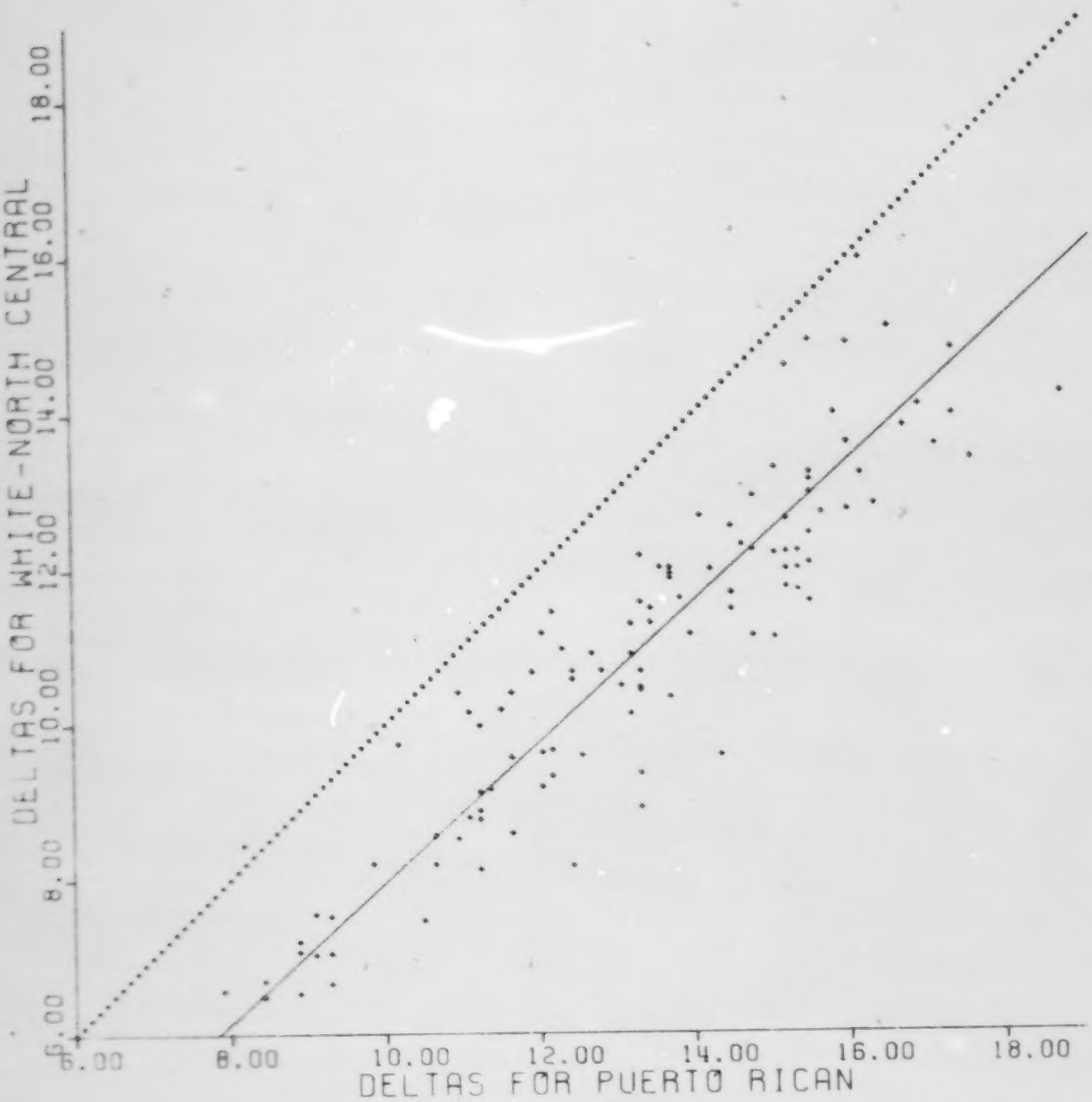

Figure 4

Cross-plot of Deltas for Mexican-American

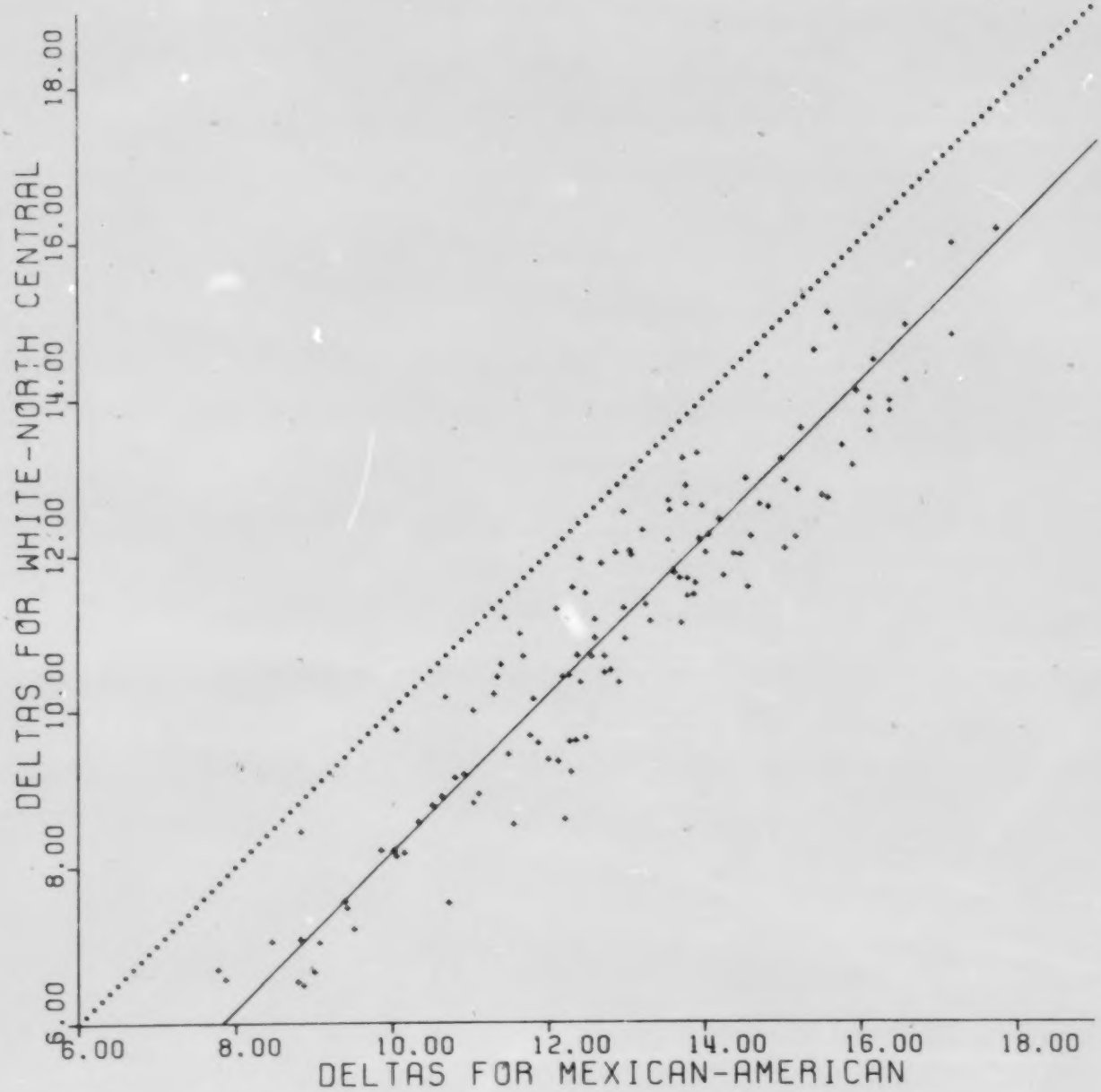

Figure 5

Cross-plot of Deltas for Other Latin-American

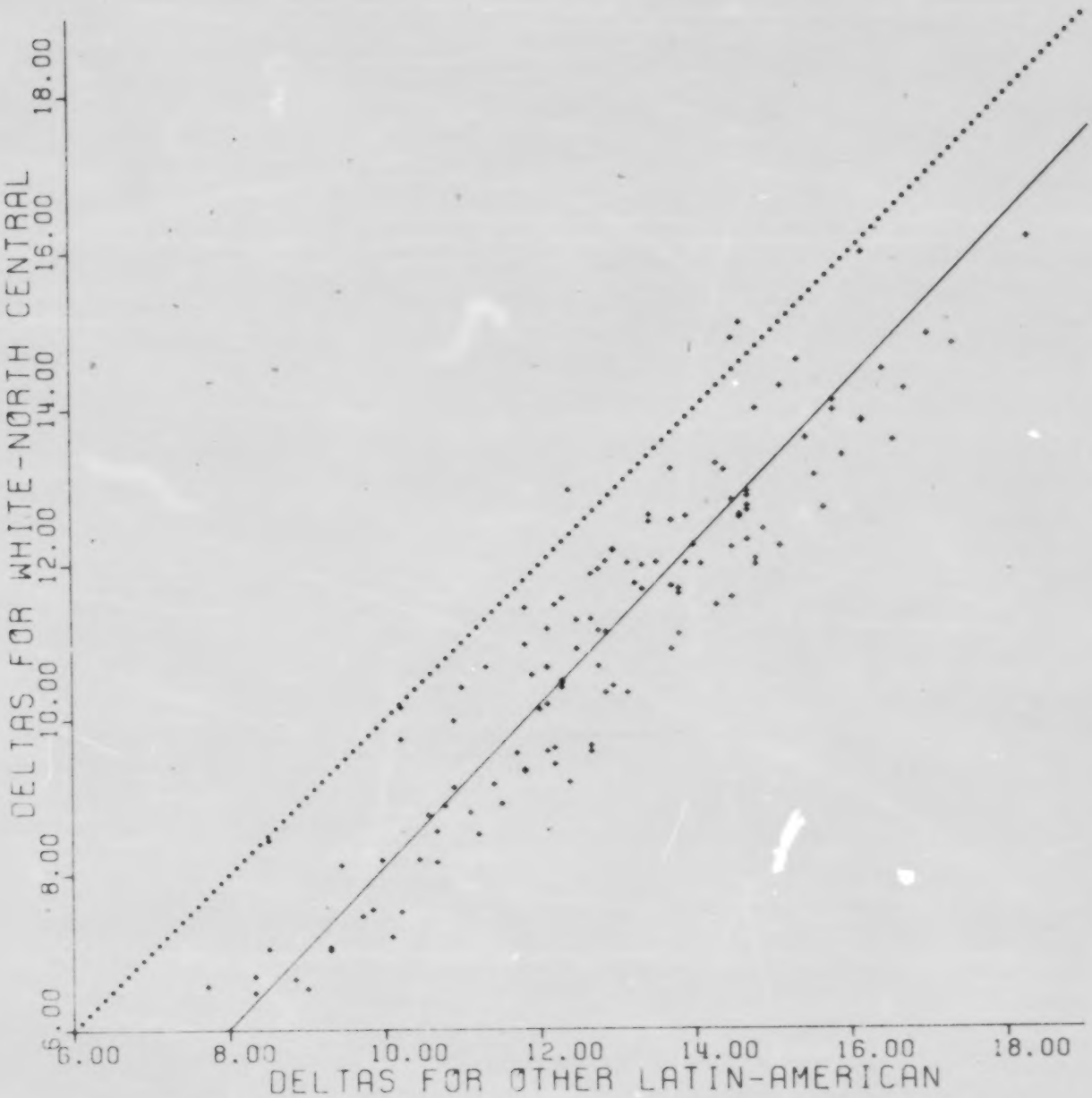

Figure 6

Cross-plot of Deltas for Oriental

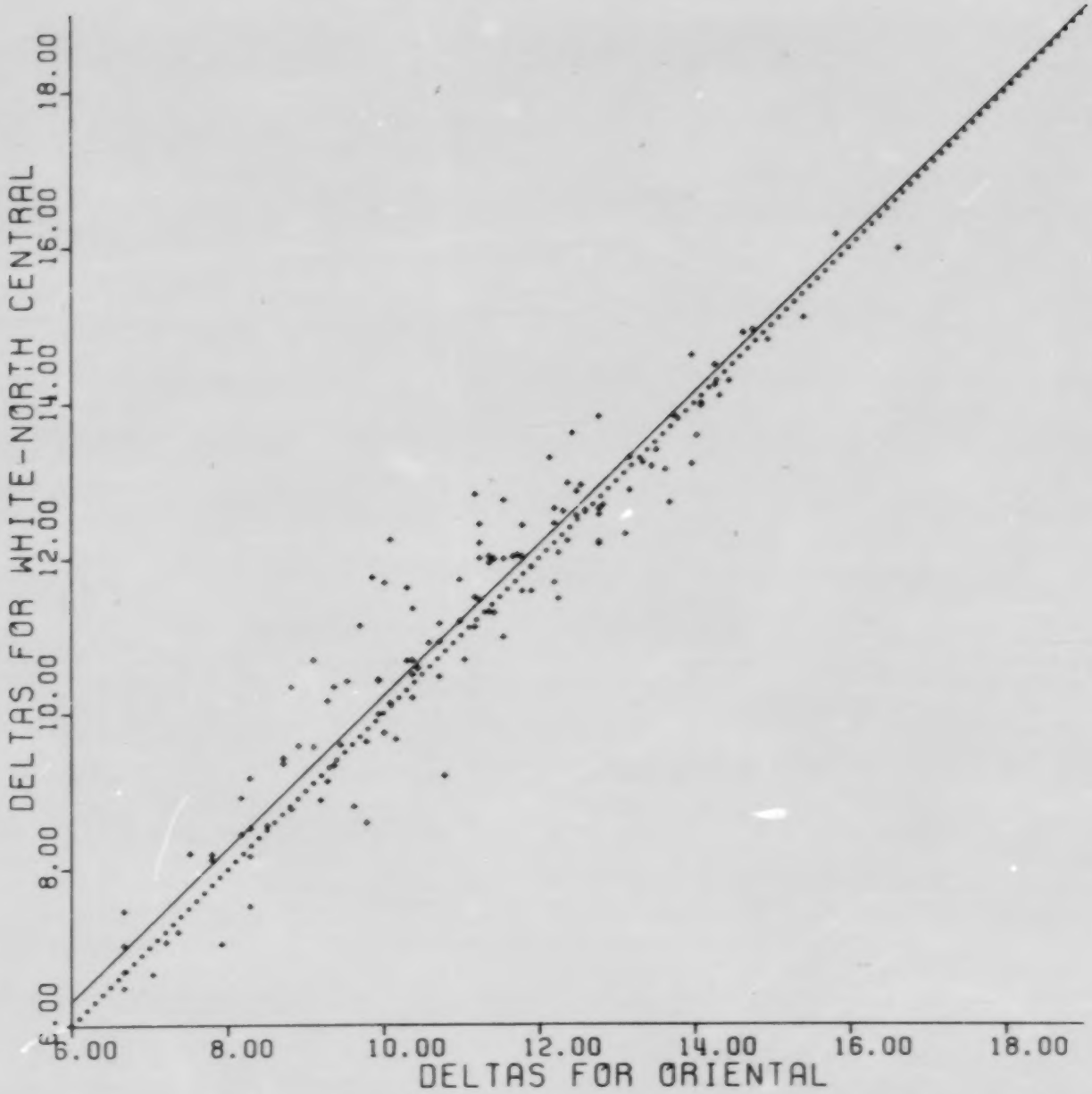

Figure 7

Cross-plot of Deltas for White-Northeastern

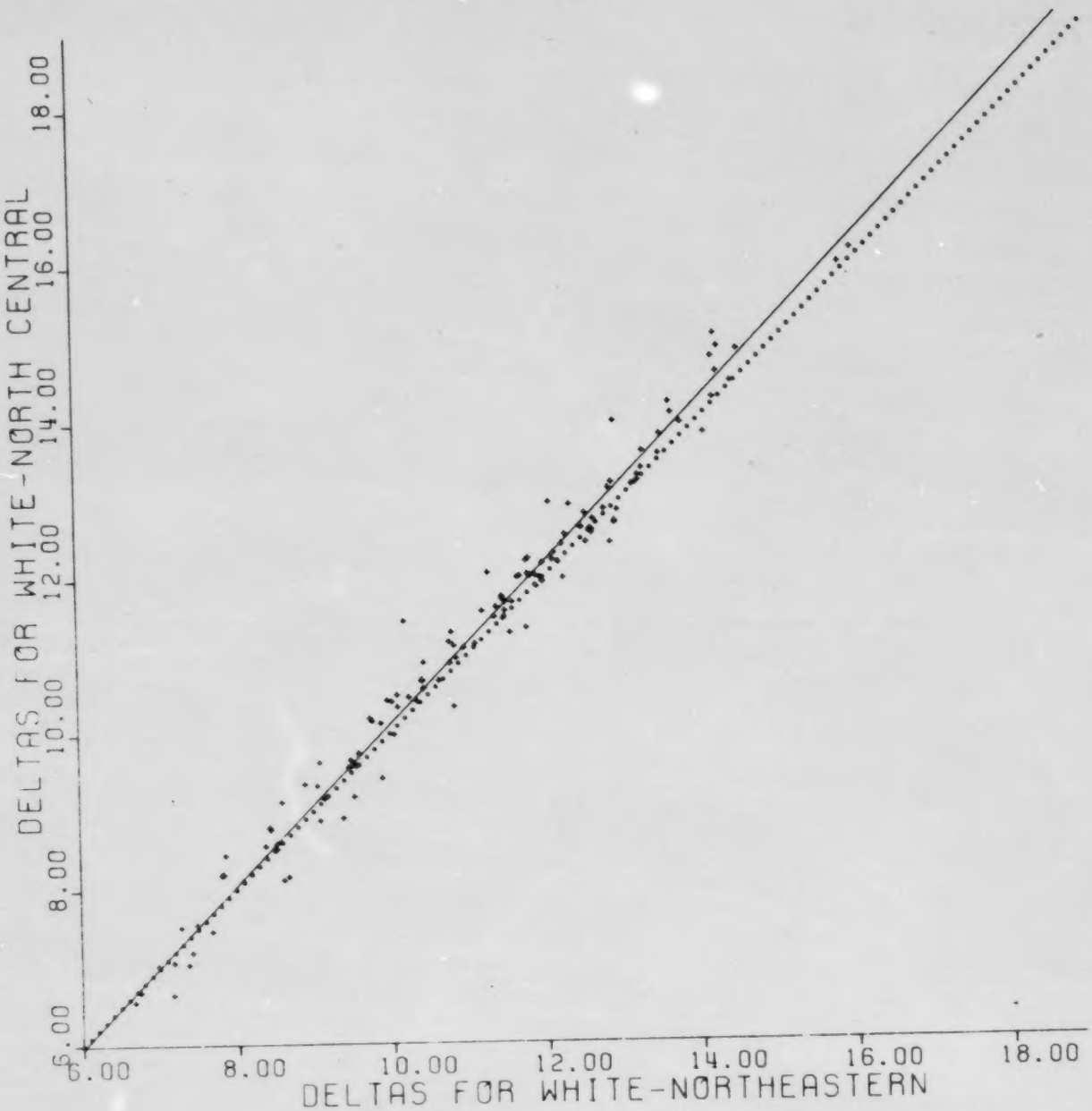

Figure 8

Cross-plot of Deltas for White-Southeastern

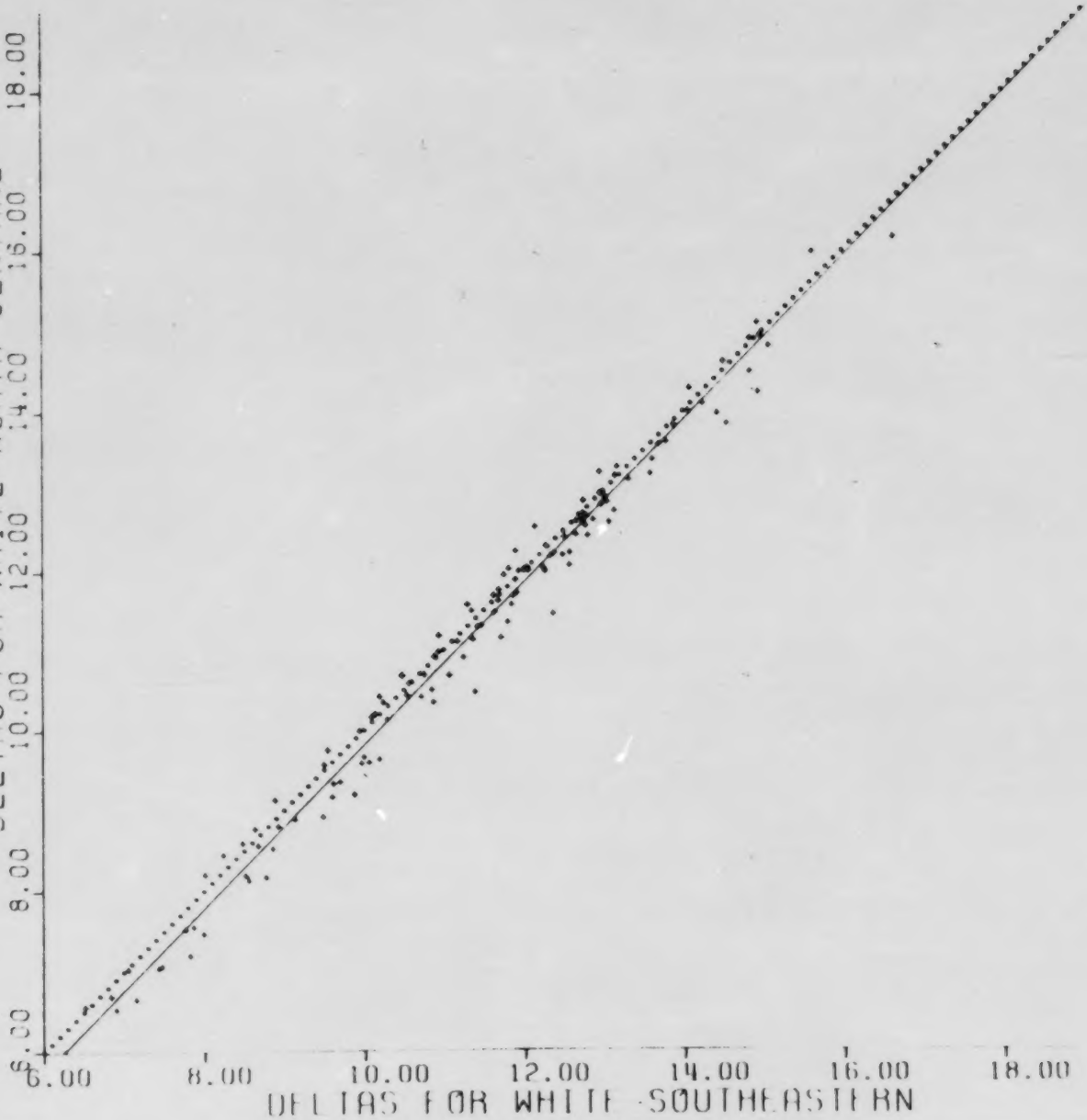

Figure 9

Cross-plot of Deltas for White-Western

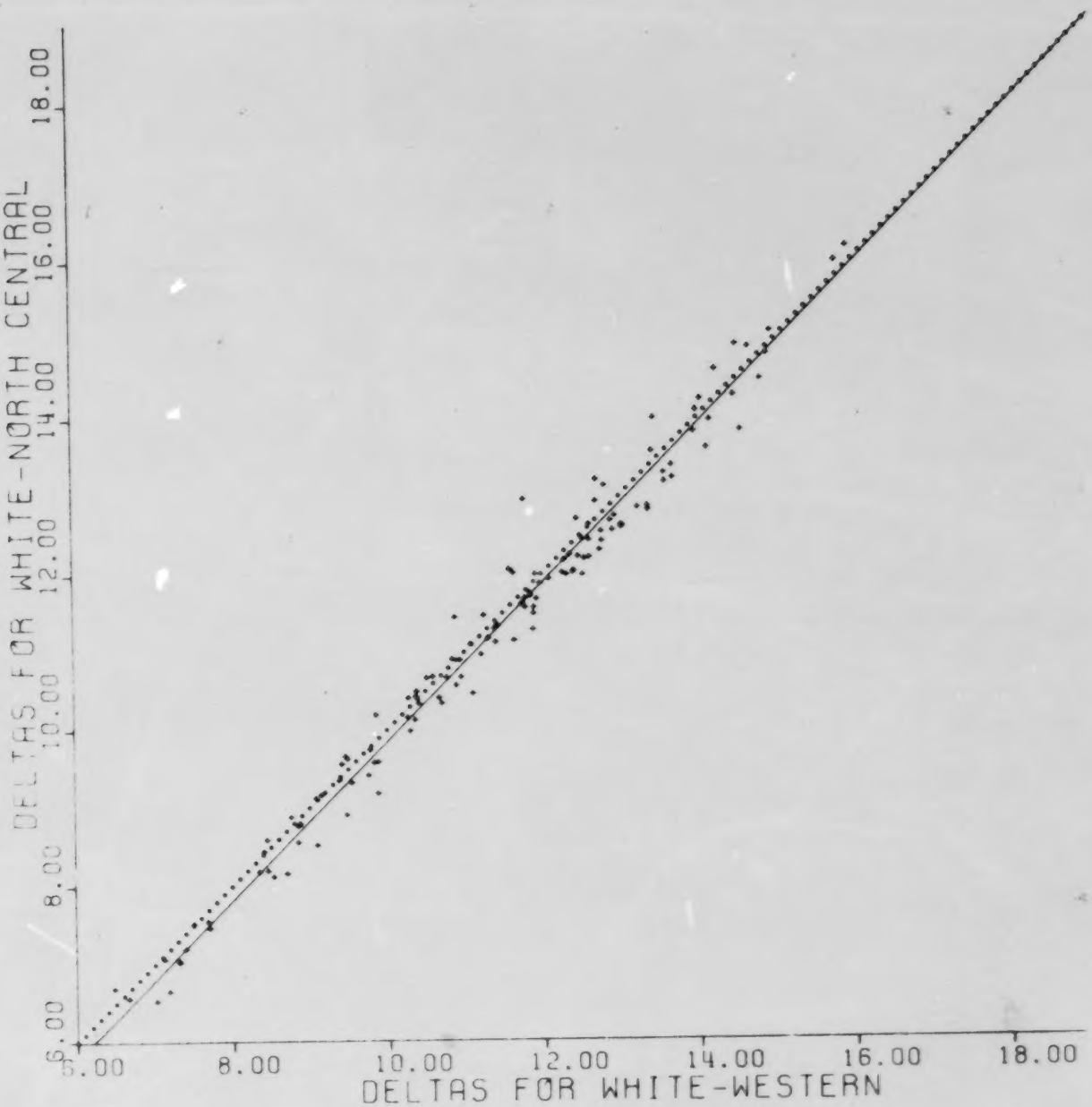

TABLE 5
ITEM D-VALUES BY GROUP
VOCABULARY

ITEM	AI	AA	MA	PR	OL	OR	WE	WS	WW	ITEM MEAN	ITEM S.D.
I- 1	0.81	0.51	0.98	-0.15	0.56	0.73	-0.15	0.02	-0.15	0.35	0.43
I- 2	0.30	-0.39	-0.16	-0.02	-1.64	-0.30	-0.48	-0.10	-0.92	-0.41	0.54
I- 3	0.88	0.83	0.73	0.13	0.53	0.27	-0.32	0.26	-0.21	0.34	0.41
I- 4	0.79	0.55	0.38	-1.13	-1.01	-0.01	-0.78	0.55	-0.49	-0.13	0.70
I- 5	0.68	0.25	1.28	0.64	1.18	1.01	-0.00	-0.22	-0.22	0.51	0.55
I- 6	-0.33	-0.44	-0.31	-0.90	-0.69	0.54	0.00	0.01	0.00	-0.24	0.41
I- 7	0.61	0.36	0.83	0.65	0.71	0.26	-0.43	0.26	-0.43	0.31	0.44
I- 8	0.02	0.18	0.44	0.47	0.11	0.18	0.05	0.25	0.08	0.20	0.15
I- 9	0.03	0.16	-0.01	0.24	-0.38	0.64	-0.07	0.18	-0.43	0.04	0.31
I-10	0.04	0.19	0.69	-0.15	0.52	0.45	-0.05	0.04	-0.30	0.16	0.31
I-11	0.19	0.30	0.40	1.21	0.59	0.12	-0.24	0.43	-0.19	0.31	0.41
I-12	0.51	-0.02	0.42	-0.15	0.64	0.18	-0.24	0.12	0.02	0.16	0.28
I-13	-0.82	-0.74	-0.70	-1.13	-1.47	-0.10	-0.06	-0.11	-0.21	-0.55	0.48
I-14	-0.82	-0.79	-0.91	-0.92	-1.53	0.30	-0.41	-0.19	-0.15	-0.60	0.51
I-15	0.00	0.51	0.24	-0.57	-0.62	0.16	-0.55	-0.03	-0.45	-0.15	0.39
GROUP MEAN	0.19	0.10	0.29	-0.12	-0.17	0.30	-0.25	0.10	-0.27		
S.D.	0.529	0.467	0.591	0.682	0.908	0.326	0.238	0.215	0.243		

***** D-VALUES NOT COMPUTED FOR MISSING ITEM-DELTAS

TABLE 6
ITEM D-VALUES BY GROUP
PICTURE-NUMBER

ITEM	AI	AA	MA	PR	CL	OP	WE	WS	WW	ITEM MEAN	ITEM S.D.
I- 1	-0.52	-1.09	-1.09	-1.01	-0.61	0.01	-0.18	-0.29	0.00	-0.53	0.42
I- 2	-0.33	-0.26	-0.54	-0.68	-0.66	0.12	0.13	-0.16	0.12	-0.26	0.31
I- 3	-0.84	-0.82	-1.07	-1.20	-0.98	0.35	-0.04	-0.28	-0.06	-0.55	0.52
I- 4	-0.46	-0.44	-0.81	-0.69	-0.66	0.55	0.03	-0.14	0.08	-0.28	0.42
I- 5	-0.24	-0.50	-0.92	-0.72	-0.88	0.18	0.16	-0.29	0.26	-0.27	0.41
I- 6	-0.58	-0.60	-0.83	-0.56	-0.50	0.02	0.12	-0.18	0.13	-0.33	0.34
I- 7	-0.30	-0.18	-0.57	-0.39	-0.84	0.40	-0.09	-0.27	0.10	-0.24	0.34
I- 8	-0.41	-0.36	-0.94	-0.47	-0.66	-0.27	0.17	-0.24	0.03	-0.35	0.31
I- 9	-0.69	*****	-0.67	-0.76	0.21	0.21	0.32	-0.03	0.07	-0.17	0.43
I-10	-0.41	*****	-0.64	*****	0.08	0.32	0.10	-0.18	0.28	-0.06	0.33
I-11	-0.49	*****	-0.47	*****	-0.67	-0.19	0.04	-0.04	0.20	-0.23	0.30
I-12	-0.38	*****	*****	*****	*****	0.30	0.14	-0.12	0.22	0.03	0.25
I-13	-0.31	*****	*****	*****	-0.18	-0.34	0.04	0.06	0.19	-0.09	0.20
I-14	*****	*****	*****	*****	*****	-0.33	0.01	-0.04	0.18	-0.04	0.18
I-15	*****	*****	*****	*****	*****	-0.15	0.23	0.04	0.20	0.08	0.15
I-16	-0.77	-1.14	-0.62	-1.19	-0.88	-0.16	0.05	-0.28	0.08	-0.55	0.46
I-17	-0.38	-0.62	-0.75	-0.45	-0.74	0.37	-0.14	-0.31	0.07	-0.38	0.40
I-18	-1.32	-1.13	-1.01	-1.59	-1.31	-0.01	-0.36	-0.30	-0.15	-0.80	0.56
I-19	-0.34	-0.92	-0.68	-0.61	-0.45	-0.12	-0.00	-0.25	0.09	-0.36	0.31
I-20	-1.16	-1.07	-0.98	-0.39	-0.61	0.08	-0.04	-0.39	0.09	-0.50	0.46
I-21	-0.23	-0.60	-0.70	-0.32	-0.41	0.24	0.31	-0.02	0.34	-0.15	0.37
I-22	-0.70	-0.71	-0.58	-0.31	-0.76	-0.09	0.03	-0.22	0.20	-0.35	0.33
I-23	-0.52	-0.29	-0.51	0.50	-0.29	-0.18	0.32	-0.14	0.30	-0.09	0.35
I-24	-0.66	-0.27	-0.70	-0.31	-0.33	0.06	-0.00	-0.13	0.13	-0.25	0.28
I-25	-0.44	-0.63	-0.90	*****	-0.59	0.21	0.13	-0.22	0.08	-0.29	0.38
I-26	-0.57	-0.17	-0.71	-0.42	-0.69	0.15	0.15	-0.10	-0.01	-0.26	0.32
I-27	-0.36	*****	-0.31	*****	-0.31	0.11	0.15	-0.07	0.23	-0.08	0.23
I-28	-0.24	*****	-0.57	*****	-0.41	0.26	0.20	0.06	0.16	-0.07	0.31
I-29	-0.38	*****	-0.63	-0.12	0.47	0.68	0.02	-0.12	0.24	0.02	0.41
I-30	-0.44	*****	-0.56	*****	-0.66	-0.09	-0.04	-0.10	0.19	-0.24	0.29
GROUP MEAN	-0.54	-0.62	-0.72	-0.56	-0.53	0.09	0.06	-0.16	0.13		
S.D.	0.261	0.321	0.194	0.440	0.365	0.252	0.149	0.116	0.109		

***** D-VALUES NOT COMPUTED FOR MISSING ITEM-DELTAS

TABLE 7
ITEM D-VALUES BY GROUP
REACTING

ITEM	AI	AA	HA	PR	OL	CR	WI	WS	HH	ITEM MEAN	ITEM S.D.
I- 1	0.49	-0.16	0.30	0.11	0.32	0.75	-0.21	-0.06	-0.07	0.16	0.31
I- 2	0.49	-0.62	-0.49	-0.65	0.07	0.28	-0.24	-0.17	-0.34	-0.18	0.37
I- 3	0.44	-0.45	-0.12	-0.26	0.26	-0.29	-0.23	-0.29	0.06	-0.10	0.28
I- 4	-0.22	-0.92	-0.64	-0.39	-0.15	0.01	-0.24	-0.14	-0.14	-0.25	0.26
I- 5	0.56	-0.73	0.66	-0.73	-0.26	-0.11	-0.09	-0.20	-0.21	-0.20	0.37
I- 6	0.26	0.28	0.35	-0.09	0.22	-0.16	-0.01	-0.19	-0.22	0.05	0.21
I- 7	0.26	0.45	0.20	0.02	0.17	0.21	0.05	0.07	-0.09	0.15	0.15
I- 8	0.49	0.51	0.42	0.60	0.25	-0.41	-0.11	-0.06	-0.14	0.17	0.34
I- 9	0.09	-0.27	0.33	0.34	0.39	0.51	-0.18	0.01	0.21	0.21	0.32
I-10	-0.10	-0.38	0.15	-0.52	0.10	-0.03	-0.10	-0.11	-0.35	-0.15	0.21
I-11	-0.12	-0.16	0.21	-0.49	0.03	-0.16	-0.27	-0.05	-0.24	-0.14	0.19
I-12	0.08	-0.28	-0.10	-0.04	-0.06	0.25	-0.32	-0.31	-0.15	-0.10	0.19
I-13	0.48	0.56	0.43	0.41	0.76	0.63	0.12	0.00	-0.23	0.36	0.31
I-14	-0.13	-0.34	-0.09	-1.47	0.32	-0.04	-0.27	-0.09	-0.35	-0.27	0.47
I-15	-0.17	-0.62	-0.41	-1.81	-1.01	0.52	0.13	-0.31	-0.16	-0.43	0.64
I-16	0.20	0.32	0.77	0.27	0.90	0.79	0.31	-0.03	-0.26	0.36	0.37
I-17	-0.81	-0.77	-0.69	-1.44	-0.66	-0.36	-0.06	-0.15	-0.31	-0.53	0.40
I-18	0.02	0.73	0.57	1.06	0.67	0.19	0.01	-0.07	-0.11	0.34	0.40
I-19	-0.16	0.20	0.06	0.09	0.03	0.26	-0.12	0.03	-0.13	0.03	0.14
I-20	0.20	0.72	0.54	0.61	0.94	0.42	0.12	-0.00	-0.17	0.37	0.34
GROUP MEAN	0.12	-0.10	0.14	-0.22	0.16	0.17	-0.08	-0.11	-0.17		
S.D.	0.333	0.513	0.392	0.725	0.464	0.358	0.164	0.113	0.134		

***** D-VALUES NOT COMPUTED FOR MISSING ITEM-RESPONSES

TABLE 8
ITEM D-VALUES BY GROUP
LETTER GROUPS

ITEM	AI	AA	MA	PR	OL	OR	WC	WS	WW	ITEM MEAN	ITEM S.D.
I- 1	0.26	-0.06	0.34	-0.19	0.70	0.32	0.17	0.28	0.00	0.20	0.25
I- 2	0.32	-0.46	-0.10	-0.17	-0.29	0.18	-0.24	0.00	-0.03	-0.09	0.22
I- 3	-0.56	-0.28	0.01	0.27	-0.08	-0.09	-0.24	0.08	-0.01	-0.10	0.22
I- 4	-0.39	0.13	0.40	0.04	-0.08	0.35	*****	*****	*****	0.07	0.27
I- 5	1.01	0.49	0.36	0.18	0.00	0.07	-0.19	0.13	-0.18	0.21	0.35
I- 6	0.25	-0.01	0.15	0.08	0.24	-0.04	-0.03	-0.14	0.06	0.06	0.13
I- 7	0.56	-0.14	-0.02	-0.72	0.06	-0.46	-0.19	0.09	-0.19	-0.11	0.34
I- 8	0.20	0.30	0.32	0.37	0.02	0.33	-0.07	0.53	0.36	0.27	0.17
I- 9	0.26	0.09	0.20	-0.04	0.74	-0.08	0.02	0.12	-0.07	0.14	0.24
I-10	0.61	-0.25	-0.03	-0.01	0.17	0.15	-0.08	-0.07	0.08	0.06	0.23
I-11	0.24	-0.08	0.21	0.19	0.85	0.51	-0.05	0.11	-0.25	0.19	0.31
I-12	-0.24	0.12	0.31	0.31	0.37	*****	*****	0.09	0.20	0.17	0.19
I-13	0.08	-0.29	0.01	-0.31	0.27	*****	-0.03	0.06	-0.04	-0.03	0.18
I-14	0.52	0.20	0.02	0.39	0.52	-0.20	-0.24	-0.05	-0.14	0.11	0.29
I-15	-0.04	0.45	-0.04	0.03	0.29	-0.44	0.05	0.17	-0.12	0.04	0.24
I-16	0.58	0.45	0.59	1.20	0.45	-0.28	-0.27	0.11	-0.09	0.31	0.45
I-17	0.34	0.62	0.70	0.44	0.46	0.20	-0.13	0.07	0.04	0.31	0.26
I-18	0.23	-0.43	-0.25	0.29	-0.11	-0.16	0.08	0.29	0.26	0.02	0.25
I-19	0.05	-0.13	-0.04	0.37	0.52	-0.05	0.23	0.05	-0.02	0.11	0.21
I-20	0.58	0.63	0.62	1.72	0.91	-0.30	0.06	0.14	0.07	0.47	0.56
I-21	0.07	0.49	0.52	0.80	0.17	-0.39	-0.06	0.03	0.01	0.18	0.34
I-22	-0.39	-0.08	-0.07	*****	0.21	-0.06	0.16	0.16	0.19	0.02	0.19
I-23	-0.63	-0.08	-0.13	*****	0.40	-0.16	0.12	0.29	-0.19	-0.05	0.30
I-24	-0.35	0.48	0.30	*****	0.19	-0.09	0.17	0.24	0.23	0.15	0.24
I-25	-0.22	*****	0.53	*****	0.47	0.03	0.36	0.42	0.46	0.29	0.26
GROUP MEAN	0.13	0.09	0.20	0.25	0.30	-0.03	-0.02	0.14	0.03		
S.D.	0.396	0.327	0.262	0.505	0.303	0.257	0.167	0.148	0.177		

***** D-VALUES NOT COMPUTED FOR MISSING ITEM-DELTAS

TABLE 9
ITEM D-VALUES BY GROUP
MATHEMATICS

ITEM	AI	AA	MA	PR	OL	OR	WE	WS	WW	ITEM MEAN	ITEM S.D.
I- 1	0.50	0.35	0.36	0.22	0.59	0.02	0.04	0.09	0.29	0.33	0.26
I- 2	-0.83	-1.04	-0.91	-0.90	-1.27	-0.46	-0.20	-0.18	-0.03	-0.65	0.42
I- 3	0.09	0.06	-0.05	0.23	-0.05	0.21	-0.18	-0.24	-0.06	-0.00	0.15
I- 4	0.25	0.05	-0.04	0.14	0.03	0.39	0.20	0.04	-0.20	0.10	0.17
I- 5	1.36	0.47	0.54	0.72	0.51	-0.91	-0.08	-0.20	-0.05	0.26	0.61
I- 6	0.53	0.54	0.92	0.46	0.98	1.29	0.31	0.35	0.38	0.64	0.32
I- 7	0.03	0.31	0.68	0.51	0.49	0.07	0.01	0.21	0.10	0.27	0.23
I- 8	0.22	0.28	0.34	-0.14	0.31	-0.79	-0.05	-0.07	0.00	0.01	0.33
I- 9	0.12	-0.14	-0.09	0.53	0.04	0.12	-0.10	-0.02	0.06	0.06	0.19
I-10	0.05	0.17	0.14	0.25	0.26	-1.04	-0.00	-0.15	-0.01	-0.04	0.38
I-11	-0.14	0.35	0.22	0.26	-0.07	0.50	0.06	0.03	0.10	0.14	0.19
I-12	0.79	-0.28	-0.08	-0.14	0.21	-0.96	-0.09	-0.07	-0.16	-0.09	0.43
I-13	0.48	0.39	0.27	0.85	-0.03	-0.86	-0.10	0.05	0.10	0.13	0.45
I-14	0.03	0.66	0.17	0.21	-0.26	-0.06	0.07	0.16	-0.02	0.11	0.24
I-15	0.21	-0.21	0.49	-0.15	0.77	-0.27	0.11	0.09	0.16	0.13	0.32
I-16	0.84	0.34	0.01	0.02	0.01	-1.39	-0.15	-0.35	0.00	-0.08	0.56
I-17	0.29	-0.09	0.05	0.68	-0.20	-1.20	-0.09	-0.16	-0.02	-0.08	0.47
I-18	0.25	0.13	0.41	0.43	0.83	0.22	0.06	0.15	0.10	0.29	0.23
I-19	0.23	-0.10	-0.04	0.25	-0.70	-0.54	0.14	0.11	0.18	-0.05	0.33
I-20	0.75	0.78	0.85	1.02	0.84	0.29	0.07	0.09	0.15	0.54	0.36
I-21	0.72	0.91	0.41	0.64	-0.03	-1.04	-0.05	0.01	0.32	0.21	0.55
I-22	0.82	0.86	0.69	0.47	0.17	-0.73	0.08	0.18	0.07	0.29	0.47
I-23	0.22	0.17	0.34	0.15	0.48	-0.64	-0.04	-0.04	0.04	0.06	0.30
I-24	0.57	0.66	0.42	1.05	0.60	0.13	0.09	0.07	0.14	0.42	0.31
I-25	0.27	-0.11	-0.11	-0.17	0.11	-0.73	-0.06	0.04	0.30	-0.05	0.27
GROUP MEAN	0.35	0.22	0.26	0.30	0.18	-0.33	0.00	0.01	0.08		
S.D.	0.412	0.418	0.394	0.419	0.490	0.640	0.119	0.156	0.141		

***** D-VALUES NOT COMPUTED FOR MISSING ITEM-DELTAS

TABLE 10
ITEM D-VALUES BY GROUP
MOSAIC COMPARISONS

ITEM	AI	AA	MA	PR	OL	OR	WF	WS	WW	ITEM MEAN	ITEM S.D.
I- 1	-0.54	-0.13	-0.53	-0.12	-0.23	0.20	0.04	-0.06	-0.29	-0.18	0.23
I- 2	-0.35	-0.16	-0.37	-0.38	-0.58	*****	0.07	-0.21	-0.07	-0.[illegible]	0.19
I- 3	0.04	-0.19	-0.29	0.20	-0.34	0.02	0.24	0.11	0.05	0.07	0.33
I- 4	0.09	0.08	-0.04	-0.09	0.21	0.30	0.09	0.13	-0.10	0.07	0.13
I- 5	*****	*****	*****	*****	*****	*****	*****	*****	*****	0.0	0.0
I- 6	*****	*****	*****	*****	*****	*****	*****	*****	*****	0.0	0.0
I- 7	*****	*****	*****	*****	*****	*****	*****	*****	*****	0.0	0.0
I- 8	-0.07	0.64	0.37	0.49	0.17	0.48	0.37	0.19	0.24	0.32	0.20
I- 9	-0.19	0.56	0.09	0.70	0.24	-0.36	0.17	0.22	0.04	0.16	0.31
I-10	-0.39	0.70	0.07	0.70	-0.41	-0.04	0.36	0.16	0.17	0.15	0.38
I-11	0.05	1.11	0.12	1.49	0.45	0.27	0.40	0.28	0.26	0.49	0.45
I-12	-0.06	1.06	0.27	1.52	0.53	-0.34	0.39	0.26	0.28	0.44	0.53
I-13	-0.27	0.93	0.18	*****	0.66	-0.33	0.41	0.28	0.13	0.25	0.40
I-14	-0.26	*****	0.19	*****	0.72	-0.53	0.44	0.25	0.16	0.14	0.39
I-15	-0.11	*****	0.08	*****	*****	-0.54	0.42	0.21	-0.03	0.00	0.30
I-16	*****	*****	*****	*****	*****	-0.72	0.46	0.16	0.05	-0.01	0.43
I-17	*****	*****	*****	*****	*****	-0.70	*****	*****	*****	-0.70	0.0
I-18	*****	*****	*****	*****	*****	*****	*****	*****	*****	0.0	0.0
I-19	*****	*****	*****	*****	*****	*****	*****	*****	*****	0.0	0.0
I-20	*****	*****	*****	*****	*****	*****	*****	*****	*****	0.0	0.0
GROUP MEAN	-0.17	0.46	0.01	0.50	0.13	-0.11	0.30	0.15	0.07		
S.D.	0.188	0.490	0.260	0.637	0.434	0.471	0.149	0.136	0.158		

***** D-VALUES NOT COMPUTED FOR MISSING ITEM-DELTAS

Longitudinal Study battery used for the study. Each table contains an item identification number as the extreme left-hand column, and group identifications at the top of the next nine columns. The group identifications used are as follows: American Indian (AI), Afro-American (AA), Mexican-American (MA), Puerto Rican (PR), Other Latin-American (OL), Oriental (OR), White Northeastern (WE), White Southern (WS), and White Western (WW). Note that the White North Central Group (WC) is not shown in these tables since it is the group to which all other groups are being compared. Marginal means and standard deviations are also given in each table. The group means and standard deviations, at bottom, are useful in judging the relative ease or difficulty of an entire subtest for any given group. The item means and standard deviations, at right, provide information of a summary nature on each item. D-Values were not computed if the proportion answering correctly was less than .05 or greater than .95, or if less than 50% of the sample responded to the item.

Vocabulary. Table 5 presents the values of d_i for each group on each item of the NLS Vocabulary subtest. Negative values of d_i indicate that a particular item was easier for a group relative to other items in the NLS battery and positive values indicate that the item was more difficult for that group than were other items in the NLS battery for the same group. Table 5 would indicate that Vocabulary items 2, 4, 13, and 14 were relatively easier for Other Latin-Americans. Moreover, this relative ease extends to both Mexican-Americans and Puerto Ricans for items 13 and 14. To a slight degree, the same could be said for item 2, but with much less confidence. Item 4, however, would appear to be relatively easier only for Other Latin-Americans and Puerto Ricans. A different picture emerges from

items 13 and 14 of the Vocabulary test. Like items 2 and 4, they appear to be relatively easy for Spanish-speaking groups. But American-Indians and Afro-Americans also show large negative values for items 13 and 14. This outcome probably relates to the fact that items 13 and 14 have the lowest P-Values (proportion of sample answering correctly) of all the items in the Vocabulary test. Thus, items which are very difficult for the majority groups, may be relatively easier for minority groups than other items in the battery. Whereas the minorities as a whole find items 13 and 14 relatively easy, however, some Spanish-speaking groups find these items and others absolutely easier. A greater proportion of Other Latin-Americans answered item 2 correctly than did the White Central group (.56 to .50). The same was true for item 13 (.36 to .32) and for item 14 (.35 to .30). These P-Values are given for all items and all groups in Appendix D.

Picture-Number. In observing the results for the Picture-Number test, it should be noted that the test is in two parts of 15 items each. Fifteen picture-number combinations are first presented on a single page. The examinees are instructed to turn to the next page and not to look back. After turning the page, they are confronted with the same 15 pictures as on the previous page, but without the two-digit numbers with which the pictures were originally paired. Moreover, the pictures are now in a different order. Thus, when one observes in Table 6 for item 3 of the Picture-Number test large negative D-Values for minority groups, it is important to know that item 3 was presented second originally in the picture and number pairings. It is also important that the picture was

of something extremely common and easily identified (a dog). A similar case made be made for items 18 and 19, the 3rd and 5th items of the second part of the Picture-Number test. Item 18 (a house) had been presented on the first page as the first picture-number pair and item 20 (a hammer) as the fifth. What is of perhaps of even more interest with respect to the Picture-Number test is that the test as a whole is relatively easier for minority groups than are other tests in the battery used. This is suggested by the mean D-Values shown at the bottom in Table 6. Note, however, that Orientals do not fit the pattern of the other minority groups. In summary, the Picture-Number test appears easier for most minority groups than other kinds of tests, as are items within it which are presented early in a sequence of picture-number pairs and which contain pictures of common and easily identified objects.

Reading. In Table 7 one observes an interesting pattern of D-Values for Afro-Americans on the first five items. These D-Values are all negative and most are relatively large, suggesting that Blacks found the first five items of the Reading test relatively less difficult than the other items of the battery. This result is especially interesting in view of the fact that these first five items all relate to a passage about Black television. Another interesting pattern occurs for item 15 where minorities tend toward relatively large and negative D-Values. However, a look at the P-Values (Appendix D) for this item shows it to be extremely difficult for all groups. The overall average proportion answering correctly was only 20%--a proportion that could have been attained by guessing alone. For no single group did more than 30% answer this item correctly. Thus, the relative ease of item 15 for minority groups reflects only a depression

in the ease of the item for the other groups. Considering the entire reading test, especially in terms of the group means at the bottom of Table 7, it does not appear that the test is extremely disadvantageous for any group or set of groups.

Letter-Groups. The table of D-Values for the Letter-Groups, Table 8, is remarkably free of notable patterns. This would suggest that items of this type are relatively homogeneous across cultures. There is some suggestion, however, that this type of test may be troublesome for the Spanish-speaking groups. The group means at the bottom of Table 8 for Mexican-Americans, Puerto Ricans, and Other Latin-Americans are somewhat higher than the means for the other groups. And for the Puerto Ricans, in particular, the length of the test appears to have exacerbated this condition, as one notes an increase in D-Values as the end of the test is approached.

Mathematics. In Table 9, items 2 and 5 provide a useful contrast of an item relatively easy for minority groups (item 2) and an item relatively difficult for minority groups (item 5). Since both of these items are near the beginning of the test, the speed factor plays a minor role. In item 2, the "Value of 11 dimes" is to be compared with the quantity, "$1.11." The task is to determine which quantity is greater, if they are equal, or if the size relationship cannot be determined from the information given. For both the White Central group and the Other Latin-American group, the proportion answering this item correctly was 76%. In contrast to item 2, however, item 5 would appear to be extraordinarily difficult for minority groups relative to the other items in the entire battery. The large D-Value (1.36) for American-Indians

is especially intriguing. Item 5 of the Mathematics test posed a contrast between the quantity, "$\sqrt{9}$," and the quantity, "9." While 85% of the Oriental group answered this item correctly, only 42% of the American-Indian group did. Given the simplicity of this particular item, what is suggested is that American-Indians in the United States, as well as other minority groups, receive seriously deficient training in the fundamentals of mathematics. Item 2, which was relatively easy for the minority groups, requires a kind of knowledge easily obtained in everyday non-school life.

Mosaic Comparisons. Since only a middle group of twenty items from the NLS Mosaic Comparisons test were analyzed (the first twenty items of the second of three parts of the test), it is not appropriate to discuss these twenty items as representing the NLS battery. The results do suggest, however, that this kind of test item is relatively stable across cultures (Table 10). Table 10 suggests as well that the primary source of instability is the speededness of the test. Blacks and Puerto Ricans were most affected by this speed factor (note the increasingly large positive D-Values with item number and the low response rates for the later items as indicated by the asterisks). It is probable that the instabilities which do occur are not due to the item type, but to the fact that speeded tests are relatively more difficult for these groups than non-speeded tests.

Discussion

A number of interesting issues emerge from the results of this study. While the cross-cultural instabilities of some item types suggest problems in test construction, instabilities in other item types point to inadequacies in schooling. It is thus not entirely clear from the numerical analyses performed what action should be taken. Vocabulary items, presented in English, which are easier for Spanish-speaking persons than they are for English-speaking persons represent one example where the problem is most probably one of test construction. On the other hand, mathematics items which appear extraordinarily difficult for minority groups--despite an apparent simplicity--indicate that the schooling of most minority groups may be seriously deficient in mathematics. But the exclusion of such items from tests would preclude the detection of similar schooling problems in the future.

Nor would it seem entirely appropriate to exclude a set of items about Black television because these items were relatively easier for Blacks. Perhaps all tests need to have more such items and, additionally, items associated with other cultures as well. The decision to exclude or include specific items in a test is, therefore, a decision far removed from any purely statistical procedure. Not only do matters of content and predictive validity need to be considered, but also matters of subtle cross-cultural differences and the socio-political context that accompanies them. Nevertheless, statistical indices are especially useful when combined with other information. They were especially helpful in the present study in isolating small groups of items for further study.

The instabilities in the NLS Vocabulary subtest have some especially interesting potentialities with respect to the groups speaking Spanish as a native language. Although a thorough analysis of this possible socio-linguistic phenomenon is beyond the scope of this study, some interesting directions for research can be pointed out.

Items 2, 4, 13, and 14 of the Vocabulary test are of special interest. These are items that appeared to be relatively easier for at least some of the Spanish-speaking groups than were other items in the NLS battery. Item 2 asked for the synonym for the English verb, "convalesce." The correct response was the English verb, "recuperate." What is notable about this particular kind of item is that these same verbs have cognates in Spanish--"convalecer" and "recuperar," respectively. It is thus not surprising that Spanish-speakers did better on the item than on other items in the NLS battery. What is surprising is that one Spanish-speaking group, Other Latin-Americans, appears to have done better with item 2 than either the White North Central group or the White Southern group. Of the 60 Other Latin-Americans who attempted the item, 61 percent gave correct responses. This compares to 54 percent and 55 percent, respectively, for the White North Central group and the White Southern group. (See Appendix D for proportions of groups responding to specific items correctly).

Item 13 of the Vocabulary test is similar, since it also involves a double cognate (both the stem and the correct option are Spanish cognates). The stem of item 13 was the English adjective, "impetuous," and the correct option was the English adjective, "impulsive." The corresponding cognates in Spanish are "impetuoso" and "impulsivo." Items 4 and 14 involve cognates also but these are not double ones, since only the stem in each case is a

cognate. Apparently, however, this small advantage helps the Spanish-speaker. The stem in item 4 was "novice," which has the cognate, "novicio." And the stem in item 14 was "enigma," having the identical cognate in Spanish.

Since not only Spanish-speaking minorities but other minorities found some of these same vocabulary items relatively easier, the cross-cultural instabilities noted are not entirely attributable to language factors. In items 13 and 14, in particular, it is clear that these vocabulary words were especially difficult for the White North Central group used for comparison in computing the index. Thus what might appear to be an advantage for minorities is, in fact, due to a disadvantage for the majority groups. That is, even though majority groups are usually at an advantage when dealing with reasonably difficult vocabulary items, that advantage is destroyed when the vocabulary words become extremenly difficult. To conclude, however, that vocabulary tests should contain only extremely difficult words so as to improve the relative performance of minority groups is certainly erroneous. It is perhaps safer to suggest that vocabulary tests may be especially difficult to construct such that they are stable across cultural groups.

If one takes the view that tests should reveal cultural differences as littles as possible, then tests such as Picture-Number, Letter-Groups, and Mosaic Comparisons would appear appealing from the results of this study. But it is also true that such tests reveal little about educational differences. Reading and mathematics test items of the types studied here, conversely, indicate important cultural and educational

differences having clear implications for policy actions. If certain groups of the population cannot perform simply taught arithmetical operations, then it is important to know that such is the case so that educational programs can be designed and implemented to correct such problems. And if reading is taught best where the reading material has cultural relevance, then this would seem to have important implications for educational practice as well.

Conclusions

This study demonstrates that useful indices of the cross-cultural stability of test items (as well as tests) can be created. Perhaps further efforts will yield better indices than that used herein. The study also shows that no purely mechanical or statistical procedure is sufficient for making decisions about the inclusion or exclusion of items from a particular test. An instability across socio-cultural groups may reflect a cultural tradition that deserves recognition. In such cases, items which serve to display cultural differences play a positive role. But in other instances, where an instability suggests that the outcomes are due to some unintended and undesired consequence, these instabilities serve no useful purpose and should be eliminated if possible. A case in point is where Spanish-speaking persons perform better on English vocabulary items because the words involved may be cognates more common in Spanish than they are in English.

A perhaps more important aspect of the study, however, is that it suggests an approach to the present controversy over test bias that might be more palatable to minority groups than current approaches. Rather than emphasizing predictive analyses based on external criteria (which themselves may be biased), analyses of individual test items in the contexts of their use, socio-cultural differences, and other subjective criteria might lead to some reconciliation of issues. After having created tests having optimal cross-cultural stabilities, without the use of external criteria, the next task would be to observe the predictive consequences of such procedures. If this new approach yielded predictive validities not significantly below those commonly obtained in less cross-culturally stable tests, then it would tend to satisfy psychometricians as well as members of minority groups.

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Appendices

The appendices following this page are:

Appendix A. Sample Test Items and Answer Sheet

Appendix B. Survey Administrators Guide

Appendix C. Test Analysis

Appendix D. Item P-Values (proportions of samples responding correctly)

Appendix E. Item Delta-Values (transformed P-Values)

Symbols used in Appendices D through G:

AI - American Indian
AA - Black or Afro-American or Negro
MA - Mexican-American
PR - Puerto Rican
OL - Other Latin-American origin
OR - Oriental or Asian-American
WE - White or Caucasian, Northeastern United States
WC - White or Caucasian, North Central United States
WS - White or Caucasian, Southern United States
WW - White or Caucasian, Western United States

N - Number of cases
NR - No response
P - Proportion of sample or subsample responding correctly
MS - Mean subtest score
MT - Mean Total Test score
D - Distance, in delta units, from the major axis of the elliptical pattern of points resulting from the cross-plot of item delta-values for a group in contrast to a standard comparison group.

APPENDIX A

Sample Test Items

and

Answer Sheet

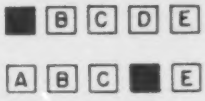
GENERAL DIRECTIONS

This test has six sections. Some sections have more than one part. During the time allowed for each section or part, you are to work only on it. The time limit for each section or separately timed part is printed at the beginning of each section or part, and the supervisor will tell you when to begin and when to stop. If you finish a section or part before time is called, go back and check your work on that section or part only.

Your score on each section will be the number of correct answers minus a percentage of the number of incorrect answers. Therefore, it will not be to your advantage to guess unless you are able to eliminate one or more of the answer choices.

Mark all of your answers on the separate answer sheet, as no credit will be given for anything written in the test book. Make your marks on the answer sheet heavy and black, as in the examples below.

Sample Answers



Be sure that the entire box is blackened.

If you wish to change an answer, erase your first mark completely.

CONTENTS OF TEST BOOK

Section 1	Vocabulary	5 minutes
Section 2	Picture-Number (Two parts of 5 minutes each)	10 minutes
Section 3	Reading	15 minutes
Section 4	Letter Groups	15 minutes
Section 5	Mathematics	15 minutes
Section 6	Mosaic Comparisons (Three parts of 3 minutes each)	9 minutes
Total		69 minutes

793101
922P24

SECTION 1

1

VOCABULARY

Time—5 minutes

Directions: Each of the questions below consists of one word followed by five words or phrases. You are to select the one word or phrase whose meaning is closest to that of the word in capital letters.

Sample Question

CHILLY:

(A) lazy
(B) nice
(C) dry
(D) cold
(E) sunny

Sample Answer

In order to find the correct answer you look at the word chilly and then look for a word below it that has the same or almost the same meaning. When you do this, you see that cold is the answer because cold is closest in meaning to the word chilly.

(This section of the test contained

15 items similar to the sample above.)

STOP

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS SECTION ONLY.
DO NOT WORK ON ANY OTHER SECTION IN THE BOOK.

SECTION 2

PICTURE—NUMBER

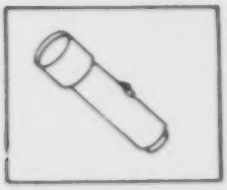
Directions: This is a test of your ability to remember picture-number combinations. The section has two parts. In each part you will study a page of fifteen pictures with numbers. On a study page the picture-number pairs will look like this:

After studying the page showing both pictures and numbers, you will be told to turn to a page showing the pictures in a different order.

Examples:

1.

2.

3. 

On your answer sheet there are ten boxes with numbers above them for each question. One of the numbers will be the number that goes with the picture. You are to blacken the box with that number above it.

Examples										
1.	12	24	41	44	51	57	65	73	77	92
2.	15	27	34	41	46	55	62	75	82	89
3.	13	19	28	44	46	58	62	67	73	97

The number that goes with the picture of a telephone is 73, so for example 1 you would blacken the box with 73 above it. For example 2 you would blacken the box with 34 above it. For example 3 you would blacken the box with 46 above it.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION 3

READING

Time—15 minutes

Directions: Each passage is followed by questions based on its content. After reading a passage, choose the best answer to each question and blacken the corresponding space on the answer sheet. Answer all questions following a passage on the basis of what is stated or implied in that passage.

SAMPLE ITEM:

Of all the forces reshaping the American city, the most powerful and insistent are those rooted in changing methods of transportation. The changes are so big and obvious that it is easy to forget how remarkable they are. The streetcar has all but disappeared, the bus is proving an inadequate substitute, commuter rail service worsens, subways get dirtier, and new expressways pour more and more automobiles into the center of town.

If transit riding continues to decline and if automobile use continues to rise unchecked, how can the vital core of the city survive? Many city planners say flatly that it cannot. The only sure way to relieve congestion and preserve the unifying core of the city, supporters of mass-transit claim, is to get people out of private automobiles and into public transit—"to move people not vehicles."

10. The author suggests that the remarkable changes in transportation are often overlooked for which of the following reasons?

(A) They have taken place very gradually over the years.
(B) They have proved to be more effective than old methods.
(C) They are so obvious that they are taken for granted.
(D) They have created new problems for city planners.
(E) They have decreased congestion in the cities.

11. The author mentions all of the following as methods of transportation which have become less popular with commuters EXCEPT

(A) the bus (B) the automobile (C) the streetcar (D) subways (E) railroads

12. The passage is primarily concerned with which of the following?

(A) Various factors influencing the American city
(B) The disappearance of the streetcar
(C) The need for faster automobiles
(D) The growing network of expressways
(E) The effects of transportation changes on the city

13. According to the passage, many city planners feel that growing use of automobiles rather than public transit will result in

(A) the construction of more and more expressways
(B) the deterioration of the vital center of the city
(C) the relief of congestion in the city
(D) a decrease in commuter rail service
(E) demands for limitations on the use of automobiles

GO ON TO THE NEXT PAGE.

(This section of the test contained 5 reading passages with accompanying questions similar to the item above.)

SECTION 4

LETTER GROUPS

Directions: Each question in this section consists of five groups of letters with four letters in each group. Four of the groups have a characteristic in common which the fifth group does not have. Decide which group is different, and blacken the space on the answer sheet that corresponds to the position (A, B, C, D, or E) of your choice.

Note: The common characteristic will not be based on the sounds of groups of letters, the shapes of letters, or whether letter combinations form words or parts of words.

Sample Questions

	A	B	C	D	E
1.	NOPQ	DEFL	ABCD	HIJK	UVWX
2.	NLIK	PLIK	QLIK	TH'K	VLIK

Sample Answers

1. [A] [■] [C] [D] [E]

2. [A] [B] [C] [■] [E]

In sample question 1, the letters in four of the groups are in consecutive alphabetical order, but group DEFL in column B is not; so space B has been marked in the sample answers. In sample question 2, four of the groups contain the letter L. Letter group THIK in column D is the group that is different, so space D has been marked in the sample answers.

You will have 15 minutes to work on this section.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

(This section of the test contained 25 questions similar to the samples above.)

Time—15 minutes

Directions: Blacken the space on the answer sheet that corresponds to the column which contains the letter group that is different.

Note: The common characteristic will not be based on the sounds of groups of letters, the shapes of letters, or whether letter combinations form words or parts of words.

	A	B	C	D	E
1.	QPPQ	HGHH	TTTU	DDDE	MLMM
2.	NABQ	PEFS	RIJV	GOPK	CUWH
3.	BCDE	FGHI	JKLM	PRST	VWXY
4.	BDBB	BFDB	BHBB	BBJB	BBLB
5.	BDCE	FHGI	JLKM	PRQS	TVWU
6.	LNLV	DTFL	CLNL	HRLL	LLWS
7.	PABQ	SEFT	VIJW	COPD	FUZG
8.	CAEZ	CEIZ	CIOZ	CGUZ	CAUZ
9.	BDEF	FHIJ	HJKL	NPQR	SVWX
10.	DCDD	HGHH	MMLM	QQQR	WWVW
11.	BCCB	GFFG	LMML	QRRQ	WXXW
12.	BVZC	FVZG	JVZK	PWXQ	SVZT
13.	ABCX	EFGX	IJKX	OPQX	UVWZ
14.	ABDC	EGFH	IJLK	OPRQ	UVXW
15.	AAPP	CCRR	QQBB	EETT	DDSS
16.	GFFG	DCCD	STTS	RQQR	MLLM
17.	ABCE	EFGI	IJKM	OPQT	UVWY
18.	XDBK	TNLL	VEGV	PFCC	ZAGZ
19.	DEGF	KLHJ	NOQP	PQSR	TURS
20.	FEDC	MKJI	DCBA	HGFE	JIHG
21.	CERT	KMTV	FHXZ	BODQ	HJPR
22.	BEPW	HJTX	KNRZ	KOSV	WRPM
23.	PXCC	EEQX	RXGG	IISX	TXLL
24.	AFBG	EJFK	GKHM	PSQT	RWSX
25.	AOUI	CTZR	JHTN	PBRL	RTVH
	A	B	C	D	E

STOP

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS SECTION ONLY.
DO NOT WORK ON ANY OTHER SECTION IN THE BOOK.

SECTION 5

MATHEMATICS

Directions: Each problem in this section consists of two quantities, one placed in Column A and one in Column B. You are to compare the two quantities and on the answer sheet blacken space

A if the quantity in Column A is greater;
B if the quantity in Column B is greater;
C if the two quantities are equal;
D if the size relationship canno: be determined from the information given.

	Sample Questions		Sample Answers
	Column A	Column B	
Example 1.	20 per cent of 10	10 per cent of 20	1. [A] [B] [■] [D]
Example 2.	6 × 6	12 + 12	2. [■] [B] [C] [D]

Answer C is marked in Example 1 since the quantity in Column A is equal to the quantity in Column B. Answer A is marked for Example 2 since the quantity in Column A is greater than the quantity in Column B.

You will have 15 minutes to work on this section.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

(This section of the test contained 25 problems following the format described above.)

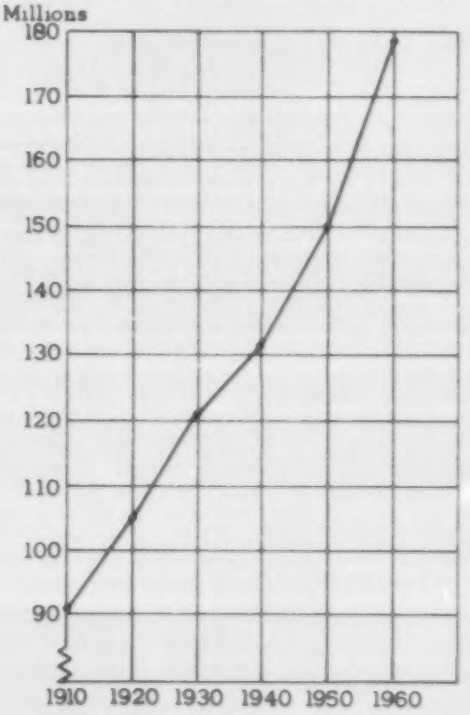
Time—15 minutes

A The quantity in Column A is greater.
B The quantity in Column B is greater.
C The two quantities are equal
D The size relationship cannot be determined from the information given.

	Column A	Column B
1.	$\begin{array}{r} 927{,}343 \\ -9{,}999 \end{array}$	$\begin{array}{r} 927{,}343 \\ -99{,}999 \end{array}$
2.	Value of 11 dimes	$1.11
3.	Length represented by 3 inches on a scale of 4 feet to an inch	A length of 12 feet
4.	$46 \div 6$	$47 \div 6$
5.	$\sqrt{9}$	9
6.	Degree rise in temperature from $-6°$ F to $+5°$ F	Degree rise in temperature from $-5°$ F to $+6°$ F
7.	The product of an even number and an odd number	The product of two odd numbers
8.	$\frac{6}{5}$	120%
9.	Average (arithmetic mean) of 30, 32, and 34	Average (arithmetic mean) of 31, 32, and 33
10.	$2(-4)$	-4
11.	Cost per apple at a rate of $0.40 per dozen apples	Cost per apple at a rate of 3 apples for $0.10
12.	245	$2(10)^3 + 4(10)^2 + 5(10)$
13.	$\frac{4 \times 3 \times 2 \times 1}{2 \times 1}$	$\frac{5 \times 4 \times 3 \times 2 \times 1}{5 \times 2 \times 1}$

Questions 14-15 refer to the following graph.

POPULATION OF THE UNITED STATES



	Column A	Column B
14.	Increase in population, in millions, 1920-1930	Increase in population, in millions, 1930-1940
15.	Ratio 1960 population in millions to 1910 population in millions	1
16.	$\frac{1}{2} + \frac{1}{3}$	$\frac{1}{2} \cdot \frac{1}{3}$
17.	$42(23) + 42(21)$	$42(23 + 21)$

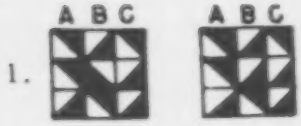
GO ON TO THE NEXT PAGE.

SECTION 6

MOSAIC COMPARISONS

Directions: This test consists of pairs of mosaics, that is, patterns of squares like those found on tiled floors or walls. Each mosaic is made up of a number of partially shaded squares. The mosaics in each pair are identical except for one square which differs in shading. The vertical columns of both mosaics are labeled A to C, A to D, or A to E according to the number of columns in the mosaic. Your task will be to locate, for each pair of mosaics, the column that contains the single square which is shaded differently. Then mark the space on your separate answer sheet that corresponds to the letter at the head of that column.

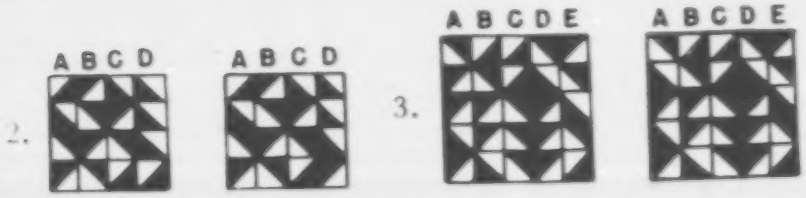
Sample Question



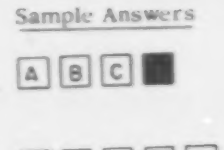
Sample Answer

In sample question 1, the right-hand and left-hand mosaics are identical except for the center square of column B, so answer space B is blackened in the sample answer.

Sample Questions



Sample Answers



In sample question 2, the bottom square in column D is the one that is different, so answer space D is blackened in the sample answers. In sample question 3, the second square in column A is the one that is different, so answer space A is blackened in the sample answers.

There are three parts to this test. All the mosaics in a single part are the same size. During the three minutes allowed for each part, you are to work on that part only. Do not move ahead to the next part until you are told to do so. Remember only one square is different for each pair of mosaics.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

(This section contained 116 mosaic comparisons, divided into 3 parts as follows:

Part 1 - 56 mosaics
Part 2 - 33 mosaics
Part 3 - 27 mosaics
116

O.M.B. No. 51-S-72008
APPROVAL EXPIRES 1-31-73

NATIONAL LONGITUDINAL STUDY OF THE HIGH SCHOOL CLASS OF 1972 FORM UEE

SCHOOL CODE

NAME (Print) Last First MI

SCHOOL NAME (Print)

STUDENT NUMBER

Be sure each mark is dark and completely fills the answer box

SECTION 1 — VOCABULARY

1	3	5	7	9	11	13	15
2	4	6	8	10	12	14	

SECTION 2 — PICTURE-NUMBER

Part 1

1	23 29 30 36 39	8	48 50 54 [illegible]	15	[illegible]
2	[illegible]	9	[illegible]	16	[illegible]
3	[illegible]	10	44 47 65 70	17	[illegible]
4	[illegible]	11	18 20 34 45 51	18	[illegible]
5	[illegible]	12	[illegible]	19	[illegible]
6	[illegible]	13	15 22 39 41 46	20	[illegible]
7	[illegible]	14	18 22 24 32 53	21	[illegible]
		15	12 22 24 35 46	22	[illegible]

Part 2

1	[illegible]	8	[illegible]	15	[illegible]
2	[illegible]	9	[illegible]	16	[illegible]
3	[illegible]	10	[illegible]	17	[illegible]
4	[illegible]	11	[illegible]	18	[illegible]
5	[illegible]	12	[illegible]	19	[illegible]
6	[illegible]	13	[illegible]	20	[illegible]
7	[illegible]	14	[illegible]	21	[illegible]
		15	[illegible]	22	[illegible]

APPENDIX B

Survey Administrator's Manual

'72

Prepared for the
UNITED STATES OFFICE OF EDUCATION
BY EDUCATIONAL TESTING SERVICE □ PRINCETON, NEW JERSEY
SPRING 1972

OE FORM NO. 2348-S 2-72. COPYRIGHT 1962, 1963, 1967, 1968, 1969, 1970 BY EDUCATIONAL TESTING SERVICE. ALL RIGHTS RESERVED.

The NLS test battery includes items from ETS tests which are in current use.

To maintain the security of these tests, only sample questions from each section have been included here.

Qualified researchers may write for a copy of the complete test booklet to:

Dr. Hunter M. Breland
Educational Testing Service
Princeton, New Jersey 08540

Survey Administrator's Manual

IMPORTANT

Please read this Manual as soon as you receive it.

'72

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NATIONAL LONGITUDINAL STUDY OF THE HIGH SCHOOL CLASS OF 1972

Conducted by
Educational Testing Service, Princeton, New Jersey, for the
UNITED STATES OFFICE OF EDUCATION
Spring 1972

SAMPLE QUESTIONS IN THIS MANUAL ARE COPYRIGHTED BY EDUCATIONAL TESTING SERVICE. ALL RIGHTS RESERVED.

TO THE SURVEY ADMINISTRATOR

This Manual has been prepared to help you carry out at your school the survey of the National Longitudinal Study (NLS) of the High School Class of 1972. The survey is being conducted for the U. S. Office of Education by Educational Testing Service (ETS).

The NLS is described in the folder *National Longitudinal Study of the High School Class of 1972* and the leaflet *Information for School Administrators*. The project will begin with a survey of students and counselors in 1,200 schools in the United States. The NLS needs the participation of 18 students and 2 counselors (where possible) in each of these schools. The students will require approximately two and one-half hours to complete a questionnaire and a short battery of tests. Counselors will spend 30 to 40 minutes filling out a questionnaire about guidance activities.

The cooperation of the students and counselors is crucial to the success of the NLS. However, you, as the Survey Administrator, have an even more critical role. In addition to answering questions about the school and providing information drawn from the school record of each student invited to participate, you must see that all tasks are carried out so that the survey at your school yields the data it is intended to yield.

This Manual explains your several functions and suggests ways to carry them out efficiently. If, after reading it, you have any questions, please telephone or cable ETS. Instructions for communicating with NLS staff at ETS are given below.

Communicating with NLS Staff at ETS

Please alert the NLS staff at ETS about any serious problem or question you may have about the survey. Call (609) 921-9000 collect from schools in the continental U. S. and ask for the NLS Project or cable from Hawaii (EDUCTESTSVC). Normal business hours are 8:30 a.m. to 4.45 p.m. Eastern Time.

Written communications and shipments of survey materials should be addressed to Educational Testing Service, P.O. Box 2608, Princeton, New Jersey 08540. If you spend any money for a telephone call, mailing, or shipment in connection with the survey, send a letter giving the amount and reason for the expenditure to the above address. You will be reimbursed.

Preparations to Date

Several steps have already been taken by ETS, by your principal, and probably also by you prior to your receiving this Manual. If there are any booklets, memoranda, or other communications about the NLS you haven't already seen, be sure to read them and confirm that all of the following actions have been taken.

1. The NLS publications previously mentioned were received by your principal in early March.
2. By the first week of March, your principal (or you) sent to ETS a Principal's Reply form identifying you as Survey Administrator and specifying preferred administration and makeup (backup) dates between April 4 and April 21.
3. Your principal (or you) sent to ETS a roster of your students in Grade 12 (or equivalent) and a roster of your staff who are assigned twelfth grade counseling duties.
4. About mid-March, ETS mailed an Information Kit of NLS materials to your principal with the request that it be forwarded to you. The Information Kit contains samples of the questionnaires, test book, and answer sheet.
5. A few days ago, you should have received a Sample Roster containing the names of students and counselors selected to participate in the survey and 30 copies of the Student Invitation folder.

If any of the above information was not supplied, telephone ETS immediately to see whether action should be taken to correct the omission. Also, if after reading this Manual, you conclude that you are not able to meet the makeup date previously specified, promptly notify ETS by telephone of the date you prefer.

Overview of Survey Administrator's Activities in April and May 1972

The following list outlines the actions you will be required to take during the course of the survey.

1. Become familiar with the aims and procedures of the survey.
2. Arrange for the release of participating students from classes so they can attend questionnaire and test sessions.
3. Receive the Sample Roster and Student Invitation folders; invite students and counselors named by ETS to participate in the study
4. Receive shipment of NLS questionnaires and test materials. Return Materials Receipt Acknowledgment postcard.
5. Supply questionnaires to participating counselors; obtain their completed questionnaires.
6. Complete (perhaps with the help of the principal or office staff) the School Questionnaire.
7. Administer the Student Questionnaire and the test battery to participating students.
8. If necessary, arrange makeup session(s) for students to take the tests and complete the questionnaire.

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9. Complete (perhaps with office staff help) a Student's School Record Information form for each student invited to participate in the study.
10. Promptly return all completed questionnaires and test answer sheets to ETS for processing.
11. If requested by ETS, supply or ask counselors or students to supply omitted data; forward these data to ETS.
12. If requested by ETS, arrange for an ETS representative to visit your school to appraise the validity of the data; assist the visitor as required.

Each of the above functions except the first is described more fully in the sections that follow.

Administrator's Checklist

On pages 16-17 of this Manual you will find a detailed schedule of Survey Administrator's tasks. A space is provided opposite each item for checking off each task when it is completed. It will facilitate your work if you review pages 16-17 frequently and keep the record up-to-date.

PRELIMINARY ARRANGEMENTS WITH PRINCIPAL AND STAFF

Once your survey materials arrive, you must proceed immediately with the detailed plans and specific arrangements for all of the tasks that are to be performed.

Review the dates sent to ETS on the Principal's Reply form. Be certain that all data collection at your school can be completed by the makeup date.

The most convenient way to handle the survey at your school would be to excuse participating students from classes and other duties for a three-hour period during which the tests would be administered (while the students are fresh) before the questionnaire. Total test administration time is 105 minutes, including 10 minutes for distributing materials and reading initial instructions, 16 minutes for reading instructions for individual tests, five minutes for collecting answer sheets, and a five-minute rest at about the halfway point. The actual testing time for the complete battery is 69 minutes. The time required for completing the Student Questionnaire ranges from 35 to 60 minutes.

If participating students cannot be released for a three-hour period, schedule two shorter periods on consecutive days. Administer the Student Questionnaire on the first day and the tests on the second. Establish the necessary procedures (for example, the issuing of passes to participating students).

You must be able to give definite arrangements and procedures to students at the time you invite them to participate in the NLS project (page 7 of this Manual).

You should also arrange for a room for the test and questionnaire administrations. Make sure that physical factors in the room, such as lighting, heating, and ventilating, will be regulated so that the students are comfortable and able to give full attention to the tests or questionnaire. The room should be in a location free from outside disturbance. The student should have both hands free to deal with a test book and answer sheet. If possible, each should have enough room to read the book and mark the answer sheet without having to pick up or shift either one. Most auditoriums are not suitable testing rooms because of deficiencies in the factors mentioned above.

You may or may not need help from the principal or the school office staff with the School Questionnaire (page 7) and the Student's School Record Information forms (page 7). You will be able to judge your needs after reviewing these materials and the pertinent school records. Make arrangements promptly for any help you do need.

Receiving Survey Materials

This Manual should have reached you with the main shipment of survey materials. Promptly check its contents against the Survey Administrator's Control Sheet. If you find any discrepancy, telephone or cable ETS immediately. Then complete the Materials Receipt Acknowledgment postcard by entering all required information including the School Code (the S.C. number on the Control Sheet) and mail it to ETS. You should have already received by first class mail a large envelope containing the Sample Roster (in duplicate) of students and counselors to be invited to participate in the survey, 30 copies of the Student Invitation folder, and a memorandum entitled "Inviting Students and Counselors to Participate in the National Longitudinal Study." If you have not received the large envelope within two days after arrival of your survey materials, telephone or cable ETS.

Storing Survey Materials

After checking your survey materials, store them in the shipping container in a closet, cupboard, or safe to which only you and authorized persons known to you have access. The test battery must be kept secure to insure accuracy of NLS results. All materials should be on hand when they are needed.

Obtaining the Cooperation of Counselors and Students

The names of the students and counselors listed on your Sample Roster were selected according to the principles of random sampling from the complete rosters of students and counselors supplied to ETS by you or your principal. They are not intended to be representative of your school or of your senior class, although in many cases they will be. The aggregate

sample in all 1,200 participating schools is representative of schools, counselors, and students throughout the nation. To retain the representative quality of the sample, it is vital that the students and counselors listed on your Sample Roster participate in the study. The importance of the NLS to today's youth and to the educational system and the unique contribution each individual can make should be impressed upon all those invited to participate.

Although participation in the study is entirely voluntary, it is important that the largest possible number of the selected students and counselors accept the NLS invitation. One of your primary functions as Survey Administrator will be to present the case for participation and obtain the cooperation of those invited students and counselors who seem reluctant to become involved in the project. If despite your best efforts you encounter unusual difficulty in obtaining the cooperation of these students or counselors, telephone ETS.

Inviting Counselors and Students to Participate

Immediately after you examine the Sample Roster, invite the listed counselors and students to take part in the survey. The memo that accompanied your Sample Roster contains detailed instructions for extending these invitations. You will probably wish to meet with the counselors to give them an opportunity to discuss the survey with you. If they wish, counselors may review materials received from ETS. Distribute a Student Invitation folder to each student on the Sample Roster to supplement your own remarks about the importance of participating in the project. Let students know that copies of the questionnaire are available for inspection at school and at home and provide copies for this purpose to students who ask for them. On the Sample Roster, record dates of invitation, acceptance, student receipt of the questionnaire, and test administration. (Keep the two copies of the Sample Roster together so that both will show any notes you make on the top copy.)

At the time a student accepts the invitation to participate in the NLS, repeat the time and place of the scheduled questionnaire and test session(s) and explain any arrangements you have made for students to be excused from classes in order to attend. Tell each student to bring his social security number, and several No. 2 pencils to the test session and these items and his driver's license number to the questionnaire administration.

COMPLETING THE SCHOOL QUESTIONNAIRE

The School Questionnaire asks questions about your school's locale, enrollment, ethnic makeup, staff, services, facilities, practices, and programs, and also about certain kinds of student results. Taken together, the completed questionnaires of the participating schools will yield a profile of the American secondary school.

All, or at least most, of the information required for the School Questionnaire has probably been compiled by the principal or another administrative staff member. The amount of help you need in completing the School Questionnaire will depend upon the availability of such data. Work on the School Questionnaire should begin immediately.

COMPLETING STUDENT'S SCHOOL RECORD INFORMATION FORMS

A Student's School Record Information form will be required for each student invited to participate in the study whether or not he actually accepts. (All data supplied on these forms will be held confidential, as explained below.) Work on these forms should begin as soon as you receive your Sample Roster. The information asked for can be drawn from a student's school records either by you or by a member of the school office staff. If several people work at this task, you must make sure that all of them follow the same procedures for researching and recording data. Review each form for completeness. Note on the Sample Roster the completion of each of these forms.

ADMINISTERING THE COUNSELOR AND STUDENT QUESTIONNAIRES

Confidentiality

It is important that completed Student and Counselor Questionnaires be examined by no one except selected ETS data-processing personnel. Therefore, ETS has provided a Confidential Questionnaire Return Envelope for each participant. These envelopes are marked TO BE OPENED ONLY BY EDUCATIONAL TESTING SERVICE NLS PROJECT MATERIALS CONTROL.

After the participants complete the questionnaires, be certain that they place them in these envelopes and return them sealed to you. You, in turn, will return them sealed to ETS.

After initial check-in at ETS, questionnaires will be identified by number only. One name-number identification file will be prepared and held in secure storage. The file will contain the names and numbers of only those students who complete the questionnaires or take the tests. Names and numbers of students who do not accept the NLS invitation will not appear in this file. The file will be used only for adding information to the main data file. There will be no possibility of associating any person's name with any subgroup or with any item of information.

Counselor Questionnaires

Prepare a questionnaire envelope set for each participating counselor by entering the School Name, School Code, and Counselor Number from the Sample Roster on the cover of the Counselor Questionnaire and the School Code and Counselor Number on a return envelope. Give the appropriate set to each counselor. These questionnaires are self-administered. Ask the counselors to return the completed questionnaires to you in the sealed envelopes within three days.

Student Questionnaires

Prepare a questionnaire envelope set for each student who has agreed to participate. Enter the Student Name, Student Number, and your School Code from your Sample Roster on the cover of the questionnaire. Enter the School Code and Student Number on page 1 and also on the return envelope.

Have several No. 2 pencils and erasers and a pencil sharpener at the questionnaire session. At the session, distribute the appropriate questionnaire envelope sets to the students. The questionnaires are, for the most part, self-administered, but you should read the directions on page 14 of this Manual to the students, answer any questions they may have, and monitor the room to maintain order and insure best results. Urge the students to be alert to the routing directions in the later sections of the questionnaire.

Questionnaire Makeup Session

If any students missed the questionnaire administration, arrange for them to attend a makeup session. If a student cannot attend this session, he may complete the questionnaire before the makeup date. If he is likely to need help in completing the questionnaire, arrange to be present when he fills it out.

GENERAL INSTRUCTIONS FOR GIVING THE TESTS

Before the testing session, study the Timetable for Administering Tests and Questionnaires on page 15. Prepare an answer sheet for each student by entering the School Code, Student Name, School Name, and Student Number.

Supplies You Will Need

When you administer the tests, you should provide the following:

A reliable watch (not a stop watch or any other mechanical timing device).

A clock (alarm clock size or larger), if possible, in the event that there is no clock in the testing room. (There should always be two timepieces in the room as a check to prevent mistiming.)

Several No. 2 pencils and erasers and a pencil sharpener.

Seating the Students

Please follow these guidelines:

- Seat the students randomly as they enter the room. Do not allow them to select their own seats.
- In a classroom, seat students in alternate rows; if space permits, leave every other seat vacant.
- In a cafeteria or library, seat students so that they are at least five feet apart. Candidates should always be seated so they face the same direction.

Seat left-handed students one behind another in a separate row or in the last seat of each row of right-handed students.

If chairs with right-hand tablet arms are used, a left-handed student should be seated so that there is a vacant chair to the left for his use.

Regulations in the Testing Room

PROHIBITION OF BOOKS, RULERS, AND OTHER AIDS: The students should have nothing on their desks except their test books, answer sheets, and several No. 2 pencils; they may not use text books, notes, dictionaries, rulers, compasses, protractors, slide rules, or other aids of any kind.

ROUTINE ABSENCES: Routine absences to go to the rest room—unlike other absences that will be discussed below—need not be noted in your survey records. No extra testing time may be allowed for a routine absence during a timed test period, and two or more students should not leave the room at the same time. Collect the test book and answer sheet from any student permitted to leave the room. Return the same test materials to him upon his return.

Problems You May Encounter in Giving the Tests

If any of the following problems occurs in connection with the tests, it should be reported on the Problem Incident Sheet included in this Manual. If you need more space than is provided, attach additional sheets to it. Be sure to indicate the test section in which any problem occurred and to fill in the identifying information. The Problem Incident Sheet will warn ETS of incidents that might affect the data. If you experience no problems in administering the tests, write *NONE* on the Problem Incident Sheet and fill in the identifying information. Return the sheet to ETS with the completed questionnaires and answer sheets.

GROUP MISTIMING: Report all mistimings. Correct any undertiming *before* you dismiss the students. On receipt of a mistiming report, ETS will decide if an overall adjustment of scores should be made.

EMERGENCIES: Emergencies such as power failure, fire, or any other event that distracts the students should be reported on the Problem Incident Sheet. If, in your opinion, the condition is likely to adversely affect student performance, move the students to another testing place. Students should not speak to one another during the move if it occurs while the test administration is in progress. If you are not able to continue satisfactorily in the original location or in another location, halt the administration, and schedule a makeup session. Telephone ETS about any problems or uncertainties regarding the resumption of testing.

DEFECTIVE TEST MATERIALS: If a student has a defective test book, you should collect it, give him a new test book, and direct him to continue working on his original answer sheet. On the cover of the defective test book, print the words DEFECTIVE MATERIAL and indicate the nature and location of the error and your school code. Return the defective test book in the shipment to ETS after the test administration. If a student indicates he has a defective answer sheet, give him a new one and direct him to write only his name on it and continue working with it, starting with the next question or the one he stopped working on. Report all such instances on the Problem Incident Sheet.

STUDENT MISTIMING: If you find a student working on a wrong section of the test, instruct him to proceed to the correct section. Record the identifying information for the student and enter:

Worked _____ minutes on section _____ of test; missed the time on section _____.

ABSENCE DUE TO ILLNESS: If a student becomes ill and must leave the room during the test, collect his test book and answer sheet.

If he is able to return and continue testing, give him the same test materials. If he has missed a substantial portion of the testing, you may prefer to have him report to the makeup administration and work on those sections of the test he missed, at the time the other students take those sections. If a student is unable to return to the test administration, notify him to report to the makeup session to take the test sections he missed.

In any case, record on the Problem Incident Sheet the identifying information and the test sections that are incomplete because of his illness. Enter:

"Left room after ____ minutes of testing. Resumed testing on or at (date or time)."

OTHER PROBLEMS: A student may mistakenly mark his answers on the wrong section of his answer sheet or in his test book. All such cases reported or detected should be entered on the Problem Incident Sheet by recording the student's identifying information and a brief explanation. Attach the test book (if it is marked) to the Problem Incident Sheet for return to ETS.

Collecting Test Materials

At the end of the testing session, first collect the test books and then the answer sheets. Do not allow a student to examine a test book or answer sheet after it has been returned to you. As you are collecting the test books, have the students check their answer sheets to make sure that the identifying information is correct.

Before going on to administer the questionnaire or to dismiss the students, count all test books (used, unused, and defective) and confirm that none is missing.

When all test materials are in your possession, please thank the students for participating in the NLS. Then read the directions for completing the questionnaire or dismiss the students. Return the test materials to locked storage until they are ready to be sent to ETS.

Test Makeup Session

As soon as the test administration has been completed, advise those students who missed the session, or who had to leave before the end of the session, of the makeup date and obtain their confirmation that they will attend.

The most important objective of the survey is to gather complete data from students and counselors in your sample. If, to achieve maximum participation, you have to schedule a makeup date later than the one originally announced, try to schedule it before April 21; in any case, telephone ETS promptly.

ASSEMBLING AND MAILING INSTRUCTIONS

Survey materials should be assembled, checked, and returned to ETS as soon as possible but not later than five days after the test makeup administration. Check all completed Student's School Record Information forms to be certain that a form has been completed for each student on the Sample Roster. Count all answer sheets and all envelopes containing Student Questionnaires and Counselor Questionnaires. Indicate on the Roster the items received from each student and counselor. Place all the answer sheets in the single Answer Sheet Envelope.

In the carton supplied for returning NLS materials to ETS, place the following:

1 copy of the Sample Roster

All completed Student Questionnaires, each in its own return envelope

All Counselor Questionnaires, each in its own envelope

1 School Questionnaire

All completed Student's School Record Information forms

All completed answer sheets in the single Answer Sheet Envelope

Any defective test books and any test books containing answers (see page 9)

Problem Incident Sheet

Attach to the carton one of the shipping labels you received in your main shipment of survey materials and send the carton to ETS. Complete the Notification postcard and mail it to ETS.

FOLLOW-UP TO OBTAIN MISSING DATA

The NLS Project Materials Control staff will promptly review the returned questionnaires and forms for completeness and will ask you to request students and counselors to supply any information that appears to have been inadvertently omitted. You will not be asked to urge participants to supply information they are reluctant to provide.

The initial shipment of survey materials included a sufficient supply of questionnaires for follow-up work. If, however, you should discover that you need more copies of any item, please call ETS for additional supplies. Prepare a questionnaire envelope set for each counselor or student who will supply missing data. Obtain their numbers from your copy of the Sample Roster. Ask the students and counselors to seal their questionnaires in envelopes. Forward all materials containing supplementary data to ETS in the large (10″ x 13″) follow-up envelope included with the basic shipment. ETS will process these questionnaires in the manner and with the confidentiality provisions described on page 7.

DISPOSING OF SURVEY MATERIALS

After the test makeup administration, burn or shred all test books except books to be returned to ETS. If it is not feasible to shred or burn waste materials at your school, return the 20 test books to ETS. Do not send the books before May 1, 1972. Use the second shipping label you received with your survey materials on the carton containing the books.

Do not dispose of copies of the questionnaires or other NLS materials until ETS notifies you that data collection has been satisfactorily completed at your school. Questionnaires and NLS materials other than test books may be disposed of by any convenient means.

VISITS TO SCHOOLS

In order to confirm the validity of the collected data, ETS will visit approximately 5 percent of the participating schools, chosen at random, at mutually convenient times in April or May. If your school is selected for a review of this kind, you will be notified by telephone and requested to help with the arrangements for the visit.

DETAILED INSTRUCTIONS FOR GIVING THE TESTS

Your complete schedule for the administration of the tests follows. Be sure to read these instructions carefully before you administer the tests. At the administration, read aloud to the students all directions in **bold face.** Allow time for the procedure described to be carried out. Do not depart from these directions or answer any question regarding the content of the tests. This will insure that all participants in the survey take the tests under the same conditions.

When all students have been admitted and seated as directed in "Seating the Students" on page 8 of this Manual, distribute an answer sheet to each student. After the answer sheets have been distributed, be certain that each student

has the appropriate answer sheet

has a No. 2 pencil

When the students have had time to look at the answer sheet, tell them the following:

Each of you will be given a test book. If you do not understand all of the directions for each section, please raise your hand. Questions will be answered between sections but not after work on any one section has begun. There will be a five-minute rest halfway through the tests. When you receive your test book, read the directions on the back cover and look at me when you have finished. Do not turn your book over or open it until you are told to do so. Are there any questions? . . .

Be sure that for every space or box you fill in, the number on the answer sheet corresponds to the number of the question you are answering. When you fill in the boxes on the answer sheet, darken the ENTIRE box. If you change an answer, erase your first mark completely; incomplete erasures may be read as intended responses. Do not make any stray marks on your answer sheet. Remember that during the time allowed for one section or part, you may work only on it. Do not go on to any other section or part until you are told to do so.

Section 1—Vocabulary

Find the area labeled Section 1—Vocabulary on your answer sheet. In your test book, the section number will appear in the upper corner of the page. If a small number appears to the right of the section number, it will refer to the part within that section. You will have five minutes to work on Section 1. Open your test book to page 3, read the directions, and begin work.

During the administration of the tests, walk about the room to make sure that each student is working on the appropriate section or part and marking his answers in the appropriate area of the answer sheet.

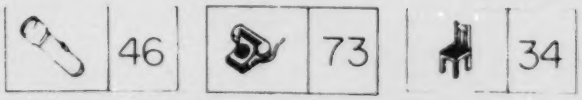
Exactly five minutes later, say:

Please stop work.

Section 2—Picture-Number

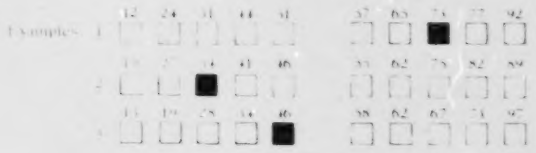
The Picture-Number test is divided into two parts of five minutes each. Each part is further divided into a three-minute segment for study and a two-minute segment for answering. During the time allowed for any one segment, you may work only on that segment. Read the directions on page 5 silently as I read them aloud. Do not turn the page to begin the test until I tell you to do so.

This is a test of your ability to remember picture-number combinations. The section has two parts. In each part you will study a page of 15 pictures with numbers. On a study page the picture-number pairs will look like the examples below.



After studying the page showing both pictures and numbers, you will be told to turn to a page showing the pictures in a different order. Look at the following examples.

On your answer sheet there are 10 boxes with numbers above them for each question. One of the numbers will be the number that goes with the picture. You are to blacken the box with that number above it. See how the examples are marked.



The number that goes with the picture of a telephone is 73, so for example 1 you would blacken the box with 73 above it. For example 2 you would blacken the box with 34 above it. For example 3 you would blacken the box with 46 above it. Are there any questions? . . . You will have three minutes to study Part 1. Turn to page 7, the study page for Part 1, and study the picture-number pairs.

Exactly three minutes later, say:

You will have two minutes to work on page 9, the test page for Part 1. Turn to page 9 and begin work.

Exactly two minutes later, say:

Please stop work. You will have three minutes to study Part 2. Turn to page 11, the study page for Part 2, and study the picture-number pairs.

Exactly three minutes later say:

You will have two minutes to work on page 13, the test page for Part 2. Turn to page 13 and begin work.

Exactly two minutes later, say:

Please stop work.

Section 3—Reading

You will have 15 minutes to work on Section 3—Reading. Turn to page 15 in your test book, read the directions, and begin work.

Exactly 15 minutes later, say:

Please stop work. Close your book and place it on top of your answer sheet.

Allow the students about five minutes of rest time. You may permit them to leave the room.

A short time before the end of the rest period, summon the students back to the room and say:

Take your seats and get ready to resume work.

Section 4—Letter Groups

You will have 15 minutes to work on Section 4—Letter Groups. Turn to page 19 in your test book and read the directions silently as I read them aloud. Do not turn the page to begin the test until I tell you to do so.

Directions:

Each question in this section consists of five groups of letters with four letters in each group. Four of the groups have a characteristic in common which the fifth group does not have. Decide which group is different and blacken the space on the answer sheet that corresponds to the position (A, B, C, D, or E) of your choice.

Note: The common characteristic will NOT be based on the sounds of groups of letters, the shapes of letters, or whether letter combinations form words or parts of words. Look at the sample questions and sample answers.

Sample Questions

	A	B	C	D	E
1.	NOPQ	DEFL	ABCD	HIJK	UVWX
2.	NLIK	PLIK	QLIK	THIK	VLIK

Sample Answers

1. [A] [■] [C] [D] [E]
2. [A] [B] [C] [■] [E]

In sample question 1, the letters in four of the groups are in consecutive alphabetical order, but group DEFL in column B is not; so space B has been marked in the sample answers. In sample question 2, four of the groups contain the letter L. Letter group THIK in column D is the group that is different, so space D has been marked in the sample answers. Are there any questions? . . . You will have 15 minutes to work on this section. Turn the page and begin work.

Exactly 15 minutes later, say:

Please stop work.

Section 5—Mathematics

Turn to the area of your answer sheet labeled Section 5—Mathematics. You will have 15 minutes to work on the Mathematics test.

Turn to page 21 in your test book and read the directions silently as I read them aloud. Do not turn the page to begin the test until I tell you to do so.

Directions:

Each problem in this section consists of two quantities, one placed in Column A and one in Column B. You are to compare the two quantities and on the answer sheet blacken space

A if the quantity in Column A is greater;

B if the quantity in Column B is greater;

C if the two quantities are equal;

D if the size relationship cannot be determined from the information given.

Look at the sample questions and sample answers.

Sample Questions

	Column A	*Column B*
EXAMPLE 1	20 percent of 10	10 percent of 20
EXAMPLE 2	6 × 6	12 + 12

Sample Answers

1. [A] [B] [■] [D]
2. [■] [B] [C] [D]

Answer C is marked in example 1 since the quantity in Column A is equal to the quantity in Column B. Answer A is marked for example 2 since the quantity in Column A is greater than the quantity in Column B.

You will have 15 minutes to work on this section.

Are there any questions? . . . Turn the page and begin work.

Exactly 15 minutes later, say:

Please stop work.

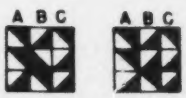
Section 6—Mosaic Comparisons

Turn to page 25 in your test book and read the directions for Section 6—Mosaic Comparisons silently as I read them aloud.

Directions:

This test consists of pairs of mosaics, that is, patterns of squares like those found on tiled floors or walls. Each mosaic is made up of a number of partially shaded squares. The mosaics in each pair are identical except for one square which differs in shading. The vertical columns of both mosaics are labeled A to C, A to D, or A to E according to the number of columns in the mosaic. Your task will be to locate, for each pair of mosaics, the column that contains the single square which is shaded differently. Then mark the space on your separate answer sheet that corresponds to the letter at the head of that column. Look at Sample Question 1.

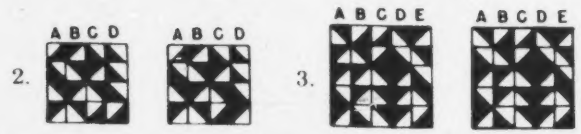
Sample Question *Sample Answer*

1. 

1. [A] [■] [C]

In sample question 1, the right-hand and left-hand mosaics are identical except for the center square of Column B, so answer space B is blackened in the sample answer. Look at examples 2 and 3.

Sample Questions



Sample Answers

2. [A] [B] [C] [■]

3. [■] [B] [C] [D] [E]

In sample question 2, the bottom square in Column D is the one that is different, so answer space D is blackened in the sample answers. In sample question 3, the second square in column A is the one that is different, so answer space A is blackened in the sample answers.

There are three parts to this test. All the mosaics in a single part are the same size. During the three minutes allowed for each part, you are to work on that part only. Do not move ahead to the next part until you are told to do so. Remember only one square is different for each pair of mosaics.

Are there any questions? . . . You will have three minutes to work on Part 1. Turn to page 27 and begin work on Part 1 on your answer sheet.

Exactly three minutes later, say:

Stop work. You will have three minutes to work on Part 2. Turn to page 30 and begin work on Part 2 on your answer sheet.

Exactly three minutes later, say:

Stop work. You will have three minutes to work on Part 3. Turn to page 32 and begin work on Part 3 on your answer sheet.

Exactly three minutes later, say:

Please stop work.

Collect test materials (see page 9).

DETAILED INSTRUCTIONS FOR ADMINISTERING THE STUDENT QUESTIONNAIRE

When all students have been admitted and seated as directed in "Seating the Students" on page 8 of this Manual, make certain that each student has the copy of the questionnaire and the return envelope you have prepared for him. Then read the explanation exactly as it is printed.

The only right answers on this questionnaire are those that reflect your own goals, experiences, and attitudes. In no case will the answers of individual students be singled out. The results, in the form of statistical summaries, will be used for research purposes only. If you are uncertain about any question, please raise your hand and I will try to help you understand what is asked for. Read the directions inside the front cover silently as I read them aloud.

SOCIAL SECURITY NUMBER. If you have a social security number, enter it in the spaces provided on the inside front cover. . . .

Directions

- **This questionnaire is divided into sections of questions. All students are asked to start by answering questions in the sections lettered A, B, and C. Then you will be asked to follow the directions to answer questions in the sections that apply to YOUR particular plans for the year after you leave high school.**
- **Read carefully ALL directions for each question you answer. It is important that you follow these directions carefully.**
- **When you are asked to circle a number, please make a heavy black circle. Look at the example.**

What grade are you in?

	(Circle one.)
Grade 9	1
Grade 10	2
Grade 11	3
Grade 12	(4)

- **Circle as many numbers as the directions indicate for each question you answer.**
- **Completely erase any answers you wish to change.**

- **When you have completed the questionnaire, put it in the envelope that has been given to you and seal the envelope. No one at your school will see or read your answers.**

This questionnaire is not a test. You may omit any question that you or your parents would consider objectionable.

On page 1, enter the following:

SEX. Circle the appropriate number to indicate your sex. . . .

DATE OF BIRTH. In the spaces provided, enter the numbers indicating the month, the day, and year of your birth. . . .

Now tell the students to fill out the questionnaire on their own.

TIMETABLE FOR ADMINISTERING TESTS AND QUESTIONNAIRES

Listed below is a suggested timetable for administering both the tests and the questionnaire at a single session. Even though you administer the tests and the questionnaire on two consecutive days, you should find this schedule helpful. Note that when both tests and questionnaire are administered in a single session, it is advisable to give the tests first, but if two separate sessions are necessary, the questionnaire should be administered in the first session.

9:00 a.m.	Distribute test materials.
9:10 a.m.	Read instructions for Vocabulary Test.
9:11 a.m.	Begin Vocabulary Test.
9:16 a.m.	Read instructions for Picture-Number Test.
9:18 a.m.	Begin Picture-Number Test.
9:28 a.m.	Read instructions for Reading Test.
9:30 a.m.	Begin Reading Test.
9:45 a.m.	Begin five-minute rest break.
9:50 a.m.	Reassemble students. Read instructions for Letter Groups Test.
9:54 a.m.	Begin Letter Groups Test.
10:09 a.m.	Read instructions for Mathematics Test.
10:13 a.m.	Begin Mathematics Test.
10:28 a.m.	Read instructions for Mosaic Comparisons Test.
10:31 a.m.	Begin Mosaic Comparisons Test.
10:40 a.m.	Stop testing. Collect answer sheets and test books.
10:45 a.m.	Begin 10-minute rest break.
10:55 a.m.	Reassemble students. Distribute Student Questionnaires.
11:00–12:00	Students complete questionnaires, seal them in envelopes, and turn them in. (There is no need, for survey purposes, for a student to remain after he has completed and turned in his questionnaire.)

ADMINISTRATOR'S SCHEDULE OF TASKS

This section of the Manual is designed to help you keep track of the tasks you have to carry out to complete your school's part in the National Longitudinal Study. Tasks that are not self-explanatory have been described in the preceding pages.

Check when completed	*NLS Deadline*	*Task*
_____	Upon appointment	1. Confirm that the following have been compiled and sent to ETS via the Principal's Reply form: a. List of your school's students in grade 12 or equivalent b. List of staff members who perform twelfth-grade counseling functions part- or full-time c. Preferred date and makeup date for data collection
_____	Upon appointment	2. Read the folder *National Longitudinal Study of the High School Class of 1972* and the leaflet *Information for School Administrators*. Review all other materials.
_____	Upon appointment	3. Review the Information Kit sent to your principal.
_____	Upon receipt of Sample Roster	4. Invite listed counselors to take part in the survey on the appointed date. Distribute invitations to students on the list and obtain their agreement to participate.
_____	Upon receipt of the Survey Administrator's Control Sheet	5. Notify the person at your school who usually receives packages to expect the NLS shipment and to inform you when it arrives.
_____	Upon receipt of the shipment	6. Check the shipment. If your shipment is incomplete, call ETS collect immediately. Complete the Materials Receipt Acknowledgment postcard and return it to ETS. Store the materials with care.
	As soon as possible	7. Arrange for a room for the administration of the questionnaire and tests.
	Upon receipt of Sample Roster	8. With assistance as needed from school office staff, complete a Student's School Record Information form for each student invited to participate.
	As soon as possible, but not later than the specified makeup date	9. Complete the School Questionnaire with assistance as needed from principal or school office staff.
	As soon as possible	10. Record the number and name of each student participant on a Student Questionnaire, envelope, answer sheet, and Student's School Record Information form. Record the identifying information for each counselor participant on a Counselor Questionnaire and envelope.

As soon as possible	11. Distribute questionnaires and envelopes (on which you have recorded the appropriate identification) to participating counselors and ask them to return the questionnaires to you within three days.
On specified date	12. Administer the Student Questionnaire.
On specified makeup date	13. If necessary, administer the Student Questionnaire to students who did not attend the earlier questionnaire session.
On specified date	14. Give the tests.
On specified makeup date	15. If necessary, give the tests to students who did not attend the earlier test session.
After each administration	16. Complete the Problem Incident Sheet.
Prior to mailing	17. Check all completed Student's School Record Information forms.
After makeup administration	18. Complete the Sample Roster form. Draw a line through the names of those counselors and students who did not participate.
As soon as possible but not later than five days after the makeup administration	19. Place the following in the carton provided for return of materials to ETS: Sealed envelopes containing Counselor Questionnaires Sealed envelopes containing Student Questionnaires Answer Sheet Envelope containing test answer sheets Student's School Record Information forms School Questionnaire One copy of Sample Roster Problem Incident Sheet Defective test books and test books containing answers to test questions (if any)
As soon as possible but not later than five days after the makeup administration	20. Mail the carton. Complete the Notification postcard and mail it to ETS.
After makeup administration	21. Destroy the test booklets.
When contacted	22. Assist ETS in following up missing data.
If requested	23. Arrange for a project staff member to visit the school at a mutually convenient time in April or May.
When notified by ETS that your data collection has been completed	24. Destroy all remaining survey materials.

O M B No 51-S-720R
APPROVAL EXPIRES 1-31-73

NATIONAL LONGITUDINAL STUDY OF THE HIGH SCHOOL CLASS OF 1972

PROBLEM INCIDENT SHEET

(Always include student identification and test section affected.)

SCHOOL NAME

SURVEY ADMINISTRATOR'S SIGNATURE

CITY AND STATE

TODAY'S DATE

SCHOOL CODE

OE FORM 2148-13 3/72

APPENDIX C

Test Analysis

Test Analysis

NATIONAL LONGITUDINAL STUDY OF THE HIGH SCHOOL CLASS OF 1972

UEE

March, 1973

SR-73-29

EDUCATIONAL TESTING SERVICE

Princeton, New Jersey—Berkeley, California

NATIONAL LONGITUDINAL STUDY OF THE HIGH SCHOOL CLASS OF 1972

UEE

March, 1973 Frances Swineford

The test battery, Form UEE, that provides part of the data collected for a national longitudinal study of the educational and career progress of a carefully designed probability sample of 1972 high-school seniors was administered in the spring of 1972 to 15,863 students, 15,596 of whom became the final working sample for the study. The test outline is as follows:

1. Vocabulary (5 minutes)
2. Picture-Number
   - Part 1. (study 3 minutes, test 2 minutes)
   - Part 2. (study 3 minutes, test 2 minutes)
3. Reading (15 minutes)
4. Letter Groups (15 minutes)
5. Mathematics (15 minutes)
6. Mosaic Comparisons
   - Part 1. (3 minutes)
   - Part 2. (3 minutes)
   - Part 3. (3 minutes)

Eleven scores were obtained for each student: a total score on each of the six sections and the score on each part of Section 2 and Section 6.

NOTES ON PRINCIPAL FINDINGS

Total Group

15,863 national sample of high-school seniors.

Sample

Sample of 1,955 cases slightly more able than total group (but see text).

Appropriateness of Test to Group

All distributions cover effective score range. Letter Groups discriminates better at low end than at high end of score scale.

Reliability

Estimates of .784 for Vocabulary, .845 for Picture-Number, .797 for Reading, .861 for Letter Groups, .866 for Mathematics, and, probably, about .90 for Mosaic Comparisons.

Speededness

Vocabulary, Reading, and Mathematics probably not unduly speeded. Evidence of some degree of speededness in Letter Groups. Speededness not measurable for Picture-Number. Mosaic Comparisons are speed tests, as intended.

Mean Item Difficulty

Mean deltas of 12.8 for Vocabulary, 12.1 for Reading, 10.4 for Letter Groups, and 11.7 for Mathematics. Deltas considered not appropriate for use with such tests as Picture-Number and Mosaic Comparisons. Middle-difficulty reference values are 12.0 for 5-choice items (Sections 1, 3, 4) and 11.7 for 4-choice items (Section 5).

Mean Biserial Correlation

Means of .63 for Vocabulary, .58 for Reading, .65 for Letter Groups, and .61 for Mathematics. Criteria are corresponding total scores.

TOTAL-GROUP STATISTICS

Frequency distributions of nine scores that were obtained for the total group are presented on pages A to E. The part scores for Picture-Number are not included on these pages, since they were not among the reported scores. All the scores extend over a wide range, from less than zero to maximum possible values. If a test were of middle difficulty for this group (except for speed tests), the mean would approximate one-half of the number of items. Vocabulary appears to be somewhat difficult; Letter Groups, quite easy; and Reading and Mathematics, near middle difficulty for the group. Picture-Number and the Mosaic Comparisons tests are speed tests, whose difficulty can not be judged in the same way as that of power tests.

SAMPLE STATISTICS

A sytematic sample of 1,955 cases was drawn for detailed analysis. For this purpose no record was accepted if one or more sections had been left blank for any reason. This restriction is more likely to eliminate low-ability

students than the able ones, and the analysis sample is indeed a little more able, on the average, than the total group, as is apparent from the score data for the power tests, given below. Since the total-group scores were recorded to three decimal places and the sample scores were rounded to the nearest whole numbers, with those ending in .5 rounded to the next higher integer, a value of 0.125 has been added to the total-group means for Vocabulary, Reading, and Letter Groups in order to make them comparable with the sample means.

	Sample		Total Group	
	Mean	S.D.	Mean	S.D.
Vocabulary	6.28	4.22	6.14	4.16
Reading	9.71	5.15	9.45	5.12
Letter Groups	16.19	5.96	15.92	6.01
Mathematics	12.53	7.47	12.25	7.43

The mean differences for Reading and Letter Groups are statistically significant at the 5 per cent level of confidence, but the actual differences are considered small from a practical point of view.

Estimates of the reliability of most of the scores are given at the top of page F. Those for Vocabulary, .784; Reading, .797; Letter Groups, .861; and Mathematics, .866, were computed by the Kuder-Richardson formula (20) adapted for use with R-KW scores. Internal estimates, such as those provided by the Kuder-Richardson procedures, are not appropriate for use with speed tests. The best estimate of the reliability of each part of Picture-Number is the correlation between them, .726. The reliability of their sum was computed by the formula,

$$\text{reliability} = 1 - \frac{\text{error variance}}{\text{total variance}},$$

where the error variance is the sum of the squared standard errors of measurement of the 15-item parts and the total variance is the variance of the 30-item total score. The resulting reliability estimate is .845. No attempt has been made to assess the reliability of the three Mosaic Comparison tests, for they differ from one another with respect to both complexity of items and number of items. Correlations between any two may well underestimate the reliability of either. The reliability of any one of them is probably no lower than .75 and possibly much higher. The reliability of their sum is probably about .90.

Intercorrelations among all eleven scores are presented in the middle portion of page F. The six correlations among the four power tests range from .496 between Vocabulary and Letter Groups to .686 between Vocabulary and Reading. The correlations among the three parts of Mosaic Comparisons are 74 between Parts 2 and 3, .63 between Parts 1 and 2, and .58 between Parts 1 and 3, which are the most dissimilar pair. It is not possible to judge the Picture-Number test with respect to its power and speed characteristics. Its correlations with the power tests are .292, Vocabulary; .355, Reading; .451, Letter Groups; and .423, Mathematics, and its correlations with the three parts of Mosaic Comparisons are .318, .364, and .352. Thus, on the average, it is more highly correlated with the power scores than with the speed scores, but the difference is extremely small.

Data relating to speededness are given at the bottom of page F. If at least 80 per cent of the group reach the last item and if virtually every one reaches at least three-quarters of the items, speed may be considered an unimportant element in the score. The data for Vocabulary, Reading, and Mathematics satisfy the first of these somewhat arbitrary criteria of an unspeeded test, but none satisfies the second. There is evidence of some speed in Letter Groups, since the last four items were reached by less than 80 per cent of the sample. The data for the Mosaic Comparison tests show all to be highly speeded, as intended. The Picture-Number tests present two difficulties: first, it is not possible to evaluate the timing allotted to the study periods, and, secondly, it can not reasonably be assumed that an examinee would record his responses in item-number order--on the contrary, it is perhaps more likely that he would first pick out the items that he best remembers and then go back to those about which he is less certain. For this reason, it has been decided not to report speed data for this test.

Special score data are presented on pages G to O, which include frequency distributions of the number of items answered right, answered wrong, omitted, and (except Picture-Number) not reached and two-way distributions of Score versus R+W. An unspeeded test would be expected to have a low NR mean and standard deviation and a high proportion of entries in the right-hand columns of the two-way table. A speed test, on the other hand, would have a high NR mean and standard deviation and a high proportion of entries along the main diagonal of the two-way table. Vocabulary, Reading, and Mathematics (pages G, J, and L, respectively) have the

characteristics of an unspeeded test. In the case of Letter Groups (page K), the NR data are low enough to suggest that the test is not speeded, but the dropping out through the last five items, already noted, and the configuration of entries near the upper end of the principal diagonal strongly suggest that a substantial proportion of the group would have increased their scores if they had been given more time.

The speed tests, Mosaic Comparison (pages M, N, and O), clearly exhibit the typical speed-test characteristics. Each NR mean exceeds the Score mean, and each NR standard deviation differs little from the Score standard deviation. The mean number of errors is only 0.87 for Part 1, 1.11 for Part 2, and 1.36 for Part 3, the slight increase consistent with the increasing complexity of the item type, and the mean number of omissions is even lower: 0.25, 0.12, and 0.13.

The configurations of entries in the two-way tables for the Picture-Number tests (pages H and I) resemble the typical speed-test configuration. But in this case failure to respond may well be more a function of memory than a function of timing. The R distributions are quite unlike the R distributions for Mosaic Comparisons. Each has its modal value at 15, the maximum possible score--a strong hint that speed is not a prominent element.

If an answer sheet were marked at random, the resulting score would most probably approximate zero, and the chances are 99 out of 100 that it would lie below the dashed line drawn near the bottom of the two-way table. Per cents of scores on the several tests that are within the chance area defined in this manner are more than 34 for Vocabulary, less than 5 for each part of Picture-Number, about 22 for Reading, 6 for Letter Groups, nearly 24 for Mathematics, and no more than 5 for any part of Mosaic Comparisons. The right-hand columns of the Mosaic Comparisons tables consistently contain scores for a few individuals who succeeded in reaching the end with a high degree of accuracy and a handful of individuals with scores within the chance area. One wonders whether the latter examinees failed to understand the directions, or felt constrained to reach the end without due regard for accuracy, or possibly had some visual deficiency that made the task particularly difficult for them.

Item statistics are summarized on page P. At the top of the page are frequency distributions of the difficulty index, delta. The numbers in the stub of the table indicate the range within which delta usually lies. The middle-difficulty value (a useful reference point) varies somewhat with the number of options per item. For a 5-choice item, such as those of Sections 1, 3, and 4, it is about 12.0, and for a 4-choice item (Section 5), it is 11.7. Not only is the Vocabulary mean delta as much as 0.8 higher (harder) than middle difficulty but also only three items are easier than this reference value, a finding that explains the large proportion of Vocabulary scores that are within the chance area.

The Picture-Number test can best be considered as a unit; that is, a group of high-school seniors can in two minutes recall with better than 50 per cent accuracy a set of 15 such items immediately after three minutes of study. For this reason information about individual items has not been included.

The mean deltas of 12.1 for Reading and 11.7 for Mathematics show both tests to be of middle difficulty for this group. The very easy Letter Group test has a mean delta of 10.4, which is 1.6 delta points below the middle-difficulty reference value.

Each part of Mosaic Comparisons is a speed test in the sense that almost every item answered was answered correctly, and few items were omitted. Consequently, item statistics are not reported for these tests.

At the bottom of page P are distributions of the biserial correlations of item scores with criterion scores. The criterion for the items in a column is the score on the section indicated at the head of that column. As one might expect when the group consists of a grade at high-school level, without selection on any basis, these correlations are high. Mean values range from .58 for Reading to .65 for Letter Groups. Few coefficients are in the .40's, and only two are in the .30's. It should also be noted that there may be a noticeable spurious effect on the correlations for Sections 1 and 3, because each item is a substantial part of its own criterion. When there are 25 or more items in a criterion, the spurious effect in the correlation between one of the items and the total is relatively small and may be ignored for practical purposes.

TEST ANALYSIS REPORT FORM

Test National Longitudinal Study Subject _____ Form UEE

Taken by Grade 12 students Date Spring 1972

Project 825 Job 50

Vocabulary				Picture-Number			
Raw Score X	Standard Score Y	f	Percentile Rank of Lower Limit of Interval	Raw Score X	Standard Score Y	f	Percentile Rank of Lower Limit of Interval
15		342	97.8	30		953	94.0
14		575	94.2	28 - 29		1156	86.7
13		720	89.7	26 - 27		973	80.6
12		208	88.4	24 - 25		920	74.8
11		786	83.4	22 - 23		1068	68.0
10		932	77.5	20 - 21		1143	60.8
9		1208	69.9	18 - 19		1166	53.5
8		1318	61.6	16 - 17		1312	45.2
7		622	57.7	14 - 15		1260	37.3
6		1414	48.8	12 - 13		1301	29.1
5		1544	39.0	10 - 11		1201	21.5
4		1597	29.0	8 - 9		1052	14.9
3		1550	19.2	6 - 7		886	9.3
2		639	15.2	4 - 5		681	5.0
1		1046	8.6	2 - 3		492	1.9
0		772	3.7	0 - 1		250	0.3
- 1		385	1.3	- 2 - - 1		47	0.01
- 2		176	0.2	- 4 - - 3		2	0.00
- 3		29	0.0				
		15863				15863	

M_x = 6.02

σ_x = 4.16

M_y = _____

σ_y = _____

Md_x = 5.64

(15 items)

Conversion Data

No conversion.

M_x = 16.76

σ_x = 8.13

M_y = _____

σ_y = _____

Md_x = 16.64

(30 items)

Conversion Data

No conversion.

TEST ANALYSIS REPORT FORM

Test National Longitudinal Study Subject _____ Form UEE

Taken by Grade 12 students Date Spring 1972

Project 825 Job 50

Reading				Letter Groups			
Raw Score X	Standard Score Y	f	Percentile Rank of Lower Limit of Interval	Raw Score X	Standard Score Y	f	Percentile Rank of Lower Limit of Interval
20		117	99.3	24 - 25		981	93.8
19		312	97.3	22 - 23		1792	82.5
18		572	93.7	20 - 21		2547	66.5
17		88	93.1	18 - 19		2448	51.0
16		740	88.5	16 - 17		1709	40.3
15		1071	81.7	14 - 15		1592	30.2
14		1166	74.4	12 - 13		1162	22.9
13		1275	66.3	10 - 11		1075	16.1
12		318	64.3	8 - 9		901	10.4
11		1167	57.0	6 - 7		493	7.3
10		1275	48.9	4 - 5		526	4.0
9		1206	41.3	2 - 3		246	2.5
8		1179	33.9	0 - 1		243	0.9
7		401	31.4	- 2 - - 1		121	0.2
6		994	25.1	- 4 - - 3		19	0.1
5		957	19.1	- 6 - - 5		8	0.0
4		802	14.0				
3		705	9.6			15863	
2		260	7.9				
1		504	4.8				
0		395	2.3				
- 1		209	0.9				
- 2		107	0.3				
- 3		19	0.2				
- 4		18	0.04				
- 5		6	0.00				
		15863					

M_x = 9.32

σ_x = 5.12

M_y = _____

σ_y = _____

Md_x = 9.88

(20 items)

Conversion Data

No conversion.

M_x = 15.79

σ_x = 6.01

M_y = _____

σ_y = _____

Md_x = 17.13

(25 items)

Conversion Data

No conversion.

TEST ANALYSIS REPORT FORM

Test National Longitudinal Study Subject _____ Form UEE

Taken by Grade 12 students Date Spring 1972

Project 825 Job 50

Mathematics				Mosaic Comparisons, Part 1			
Raw Score X	Standard Score Y	f	Percentile Rank of Lower Limit of Interval	Raw Score X	Standard Score Y	f	Percentile Rank of Lower Limit of Interval
24 - 25		1168	92.6	56		91	99.4
22 - 23		809	87.5	52 - 55		93	98.8
20 - 21		1631	77.3	48 - 51		35	98.6
18 - 19		920	71.5	44 - 47		69	98.2
16 - 17		1609	61.3	40 - 43		121	97.4
14 - 15		949	55.3	36 - 39		244	95.9
12 - 13		1616	45.1	32 - 35		400	93.4
10 - 11		1022	38.7	28 - 31		957	87.3
8 - 9		1582	28.7	24 - 27		2508	71.5
6 - 7		982	22.5	20 - 23		3698	48.2
4 - 5		1422	13.6	16 - 19		3575	25.7
2 - 3		812	8.5	12 - 15		2352	10.8
0 - 1		875	2.9	8 - 11		935	4.9
- 2 - - 1		318	0.9	4 - 7		366	2.6
- 4 - - 3		139	0.1	0 - 3		287	0.8
- 6 - - 5		9	0.0	- 4 - - 1		106	0.2
				- 8 - - 5		25	0.01
		15863		-12 - - 9		1	0.00
						15863	

M_x = 12.25	Conversion Data	M_x = 19.93	Conversion Data
σ_x = 7.43	No conversion.	σ_x = 8.43	No conversion.
M_y =		M_y =	
σ_y =		σ_y =	
Md_x = 12.37		Md_x = 19.80	
(25 items)		(56 items)	

TEST ANALYSIS REPORT FORM

Test National Longitudinal Study Subject _____ Form UEE

Taken by Grade 12 students Date Spring 1972

Project 825 Job 50

Mosaic Comparisons, Part 2				Mosaic Comparisons, Part 3			
Raw Score X	Standard Score Y	f	Percentile Rank of Lower Limit of Interval	Raw Score X	Standard Score Y	f	Percentile Rank of Lower Limit of Interval
32 - 33		140	99.1	26 - 27		120	99.2
30 - 31		53	98.8	24 - 25		52	98.9
28 - 29		93	98.2	22 - 23		111	98.2
26 - 27		159	97.2	20 - 21		254	96.6
24 - 25		341	95.0	18 - 19		674	92.4
22 - 23		632	91.1	16 - 17		1018	85.9
20 - 21		980	84.9	14 - 15		1975	73.5
18 - 19		1801	73.5	12 - 13		2495	57.8
16 - 17		2849	55.6	10 - 11		2664	41.0
14 - 15		2771	38.1	8 - 9		2919	22.6
12 - 13		2052	25.2	6 - 7		1610	12.4
10 - 11		1515	15.6	4 - 5		954	6.4
8 - 9		945	9.7	2 - 3		402	3.9
6 - 7		547	6.2	0 - 1		465	0.9
4 - 5		264	4.5	- 2 - - 1		118	0.2
2 - 3		172	3.5	- 4 - - 3		29	0.02
0 - 1		368	1.1	- 6 - - 5		2	0.01
- 2 - - 1		109	0.5	- 8 - - 7		1	0.00
- 4 - - 3		63	0.1				
- 6 - - 5		6	0.02			15863	
- 8 - - 7		3	0.00				
		15863					

M_x = 14.50	Conversion Data	M_x = 10.59	Conversion Data
σ_x = 5.76	No conversion.	σ_x = 4.84	No conversion
M_y = _____		M_y = _____	
σ_y = _____		σ_y = _____	
Md_x = 14.91		Md_x = 10.41	
(33 items)		(27 items)	

TEST ANALYSIS REPORT FORM

Test National Longitudinal Study Subject _____ Form UEE

Taken by Grade 12 students Date Spring 1972

Project 825 Job 50

Mosaic Comparisons, Total

Raw Score X	Standard Score Y	f	Percentile Rank of Lower Limit of Interval	Raw Score X	Standard Score Y	f	Percentile Rank of Lower Limit of Interval
114 - 116		43	99.7				
108 - 114		50	99.4				
102 - 108		14	99.3				
96 - 102		27	99.2				
90 - 96		36	98.9				
84 - 90		79	98.4				
78 - 84		145	97.5				
72 - 78		281	95.7				
66 - 72		593	92.0				
60 - 66		1112	85.0				
54 - 60		1842	73.4				
48 - 54		2579	57.1				
42 - 48		2824	39.3				
36 - 42		2361	24.4				
30 - 36		1658	14.0				
24 - 30		956	8.0				
18 - 24		528	4.6				
12 - 18		252	3.0				
6 - 12		152	2.1				
0 - 6		206	0.8				
- 6 - - 0		93	0.2				
- 12 - - 6		24	0.1				
- 18 - - 12		7	0.01				
- 24 - - 18		1	0.00				
		15863					

M_x = 45.01

σ_x = 16.43

M_y = _____

σ_y = _____

Md_x = 45.10

(116 items)

Conversion Data

No conversion.

M_x = _____

σ_x = _____

M_y = _____

σ_y = _____

Md_x = _____

Conversion Data

Test National Longitudinal Study Subject _____ Form UEE

Description of Sample: N = 1,955

Spaced sample

Scoring Formulae and Reliability Coefficients for Sections

Section of Test	Scoring Formula	Reliability*	$SE_{meas.}$	Section of Test	Scoring Formula	Reliability*	$SE_{meas.}$
1 Vocabulary	R-W/4	.784	1.96	4 Letter Groups	R-W/4	.861	2.23
2 Pict.-Number:				5 Mathematics	R-.333W	.866	2.73
1	R-.111W	.726**	2.28	6 Mosaic Compar.:			
2	R-.111W	.726**	2.14	1	R-W/2		
Total	R-.111W	.845**	3.13	2	R-.333W		
3 Reading	R-W/4	.797	2.32	3	R-W/4		

*Adaptation of Kuder-Richardson formula (20). **See text.

Intercorrelations of Sections

Section	1	2-1	2-2	2	3	4	5	6-1	6-2	6-3	6
1 Vocabulary		.284	.254	.292	.686	.496	.610	.210	.276	.283	.282
2 Pic.-Num.: 1	.284		.726	.933	.351	.448	.413	.305	.354	.338	.372
2	.254	.726		.924	.300	.387	.368	.284	.321	.314	.343
Total	.292	.933	.924		.355	.451	.423	.318	.364	.352	.386
3 Reading	.686	.351	.300	.355		.595	.667	.274	.342	.342	.354
4 Letter Groups	.496	.448	.387	.451	.595		.674	.387	.488	.460	.494
5 Mathematics	610	.413	.368	.423	.667	.674		.326	.388	.389	.409
6 Mosaic: 1	.210	.305	.284	.318	.274	.387	.326		.683	.579	.900
2	.276	.354	.321	.364	.342	.488	.388	.683		.739	.900
3	.283	.338	.314	.352	.342	.460	.389	.579	.739		.833
Total	.282	.372	.343	.386	.354	.494	.409	.900	.900	.833	

Speededness of Sections

Section	1	2-1	2-2	3	4	5	6-1	6-2	6-3		
Per cent completing test..	82.3			81.8	57.6	85.0	1.3	1.7	2.0		
Per cent completing 75 per cent of test .	94.7			95.9	94.7	96.3	2.5	6.2	6.1		
Number of items reached by 80 per cent of the candidates	15			20	21	25	15	12	9		
Total number of items	15	15	15	20	25	25	56	33	27		

TEST National Longitudinal Study

SECTION 1

SUBJECT Vocabulary

ITEMS 15 (5-choice)

UEE

SCORE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
14- 15														13	125		
12- 13													12	21	65		
10- 11											1	7	20	17	24	148	
8- 9										1	5	15	15	13	37	37	202
6- 7									1	4	8	9	31	30	42	16	102
4- 5								1	3	9	2	6	25	22	27	13	16	33	219
2- 3						1	2	1	1	6	22	14	20	13	16	19	24	30	102
0- 1	1	1	2	2	2	5	5	9	6	3	16	18	10	9	6	115	
-2- -1				1					5	2	8	3		4	13	34	
-4- -3												2				3	
TOTAL	1	1	2	4	5	6	21	33	35	67	94	114	105	161	193	1115	

SCORE	f
138	
98	
217	
328	
244	
376	
271	
208	
70	
5	
1955	

R (RIGHT)		W (WRONG)		O (OMIT)		NR (NOT REACHED)	
Number of items	f	Number of items	f	Number of items	f	Number of items	f
15	54	15	3				
14	84	14	10			14	1
13	78	13	29			13	-
12	92	12	55			12	-
11	127	11	80	11	2	11	-
10	150	10	137	10	-	10	3
9	180	9	139	9	4	9	7
8	193	8	180	8	13	8	11
7	198	7	179	7	18	7	16
6	186	6	193	6	37	6	21
5	190	5	200	5	47	5	33
4	180	4	199	4	83	4	47
3	115	3	192	3	87	3	57
2	74	2	153	2	163	2	85
1	45	1	126	1	216	1	65
0	9	0	80	0	1285	0	1609
1955		1955		1955		1955	
MEAN	6.28		7.61		5.82		0.96		0.61
STANDARD DEVIATION	4.22		3.54		3.34		1.75		1.01

1. Vocabulary

TEST National Longitudinal Study SUBJECT Picture-Number FORM UEE

SECTION 2, Part 1 ITEMS 15 (10-choice)

R + W / SCORE	1 TO	2 TO	3 TO	4 TO	5 TO	6 TO	7 TO	8 TO	9 TO	10 TO	11 TO	12 TO	13 TO	14 TO	15 TO	TO	TO	SCORE f	R (RIGHT) Number of Items	R f	W (WRONG) Number of Items	W f	O (OMIT) Number of Items	O f	N R (NOT REACHED) Number of Items	N R f
15															229			229								
14														79	41			120	15	229						
13													76	29	13			118	14	120			14	7		
12												71	31	10	4			116	13	118			13	23		
11											44	21	8	4				77	12	116			12	75		
10										81	39	10	3					133	11	77			11	121		
9									62	47	4	6	3					122	10	133	10	1	10	151		
8								78	46	13	9	1		1				148	9	123	9	–	9	160		
7							78	57	15	5	3		3		1			162	8	151	8	2	8	172		
6						63	42	24	9	5		1	1					145	7	160	7	11	7	187		
5					59	46	20	9	7		4	1	1					147	6	149	6	10	6	149		
4				43	55	29	11	9		1	1							149	5	143	5	27	5	136		
3			23	27	20	8	12		5	1	1	1	–	–	–	–		98	4	155	4	67	4	105		
2		15	26	26	10	11	–	–	5	–	2							99	3	99	3	102	3	112		
1	4	6	16	16	7		6	2	2									59	2	100	2	210	2	126		
0	3	2	8	9		3	2	3	1									31	1	58	1	518	1	123		
-1							1			1								2	0	24	0	1005	0	288		
TOTAL	7	23	75	121	151	160	172	187	149	156	105	112	126	123	288			1955	1955		1955		1955			

SCORE R-.1110W

2. Picture-Number, Part 1

	SCORE	R	W	O	N R
MEAN	5.38	8.41	0.93	3.66	
STANDARD DEVIATION	4.35	4.31	1.34	3.84	

EN 199285

Test: National Longitu[illegible] Study — Picture-Number — Form: UEE

Version: 2, Part [illegible] — Items: 15 (10-choice)

Item / Score	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15 TO	40	TO	SCORE f	R (RIGHT) Number of items	R f	W (WRONG) Number of items	W f	O (OMIT) Number of items	O f	NR (NOT REACHED) Number of items	NR f
15															202			202								
14														62	62			124	15	202						
13													69	55	23			147	14	124			14	5		
12												46	30	27	11			114	13	147			13	14		
11											49	40	22	10	1			122	12	114			12	27		
10										51	34	21	19	4				129	11	122			11	41		
9									57	36	29	11	10					143	10	129	10	1	10	112		
8								60	51	23	11	9		3				156	9	146	9	3	9	152		
7							65	43	20	21	8		6	1				173	8	160	8	5	8	188		
6						50	53	23	21	16		7	1	1				178	7	175	7	10	7	169		
5					25	34	23	17	9		4	5		2				143	6	180	6	22	6	182		
4				15	24	27	19	13		7	2							107	5	141	5	53	5	162		
3			11	7	25	16	13		10	3	2							89	4	113	4	110	4	143		
2		4	3	12	11	12		4	4	4	2	1						62	3	89	3	173	3	139		
1	1	5	5	3	14		4	1			1							34	2	53	2	306	2	157		
0	2	5	2	4		5	4	2	1	1	1							27	1	42	1	490	1	165		
-1					2	1	1											5	0	18	0	782	0	299		
TOTAL	5	14	27	41	112	152	18	167	182	164	143	139	157	165	299			1955	1955		1955		1955			
																		MEAN	8.72		8.77		1.33		4.90	
																		STANDARD DEVIATION	4.69		4.63		1.57		3.51	

1. [illegible]

2. Picture-Number, Part 2

TEST National Longitudinal Study SUBJECT Reading FORM UEE

SECTION 3 ITEMS 20 (5-choice)

R + W	5 TO	6 TO	7 TO	8 TO	9 TO	10 TO	11 TO	12 TO	13 TO	14 TO	15 TO	16 TO	17 TO	18 TO	19 TO	20 TO	TO	SCORE f	R (RIGHT) Number of Items	R f	W (WRONG) Number of Items	W f	O (OMIT) Number of Items	O f	NR (NOT REACHED) Number of Items	NR f
																									15	1
																									14	-
																									13	-
19- 20															2	64		66							12	-
17- 18															11	80		91							11	5
15- 16												1	7	3	8	221		240	20	12	20	2			10	3
13- 14											2	2	6	18	28	241		297	18- 19	137	18- 19	7			9	6
11- 12								1	4	4		2	12	12	20	121		176	16- 17	244	16- 17	49	8	1	8	11
9- 10						1	1	3	5	2	9	11	7	6	35	236		316	14- 15	300	14- 15	120	7	-	7	36
7- 8					1			3	7	3	1	4	23	10	15	95		162	12- 13	312	12- 13	188	6	2	6	19
5- 6	1				1	1	5	2	6	4	7	11	19	8	14	179		258	10- 11	297	10- 11	261	5	8	5	20
3- 4					3	1	2	2	7	5	5	5	6	12	13	125		186	8- 9	269	8- 9	329	4	7	4	18
1- 2					1		1	2	5	2	4	5	17	5	6	33		81	6- 7	202	6- 7	349	3	20	3	99
-1- 0							1		1	3		1	3	2	12	43		66	4- 5	139	4- 5	326	2	38	2	31
-3- -2													4	1	2	5		12	2- 3	37	2- 3	247	1	159	1	106
-5- -4																4		4	0- 1	6	0- 1	77	0	1720	0	1600
TOTAL	1	-	-	-	6	3	1	13	35	23	28	42	104	77	166	1447		1955	1955		1955		1955		1955	

MEAN	9.71	11.50		7.67	0.20	0.64
STANDARD DEVIATION	5.15	4.22		3.99	0.66	1.73

4-.2500

3. Reading

TEST National Longitudinal Study — FORM Letter Groups — UEE

SECTION 4 — ITEMS 25 (5-choice)

R + W / SCORE	1 TO 2	3 TO 4	5 TO 6	7 TO 8	9 TO 10	11 TO 12	13 TO 14	15 TO 16	17 TO 18	19 TO 20	21 TO 22	23 TO 24	25 TO	TO	TO	TO	TO	SCORE f
24- 25												32	101					133
22- 23											36	135	63					234
20- 21										31	131	62	119					343
18- 19									13	72	40	44	81					250
16- 17								2	49	35	62	43	44					235
14- 15							4	23	19	40	25	27	61					199
12- 13						3	11	11	32	15	20	30	21					143
10- 11						4	4	13	12	18	14	11	46					122
8- 9					3	4	2	4	8	6	7	17	52					103
6- 7				1	2		2	3	10	4	5	5	27					59
4- 5		1			2	1	1	1	2	2		10	47					67
2- 3		1			1				1	2	1	6	13					25
0- 1	2							1				3	18					24
-2- -1											1	1	13					15
-4- -3													1					1
-6- -5												1	1					2
TOTAL	2	2	-	1	3	12	24	58	146	225	342	427	708					1955

SCORE	R (RIGHT) Number of Items	f	W (WRONG) Number of Items	f	O (OMIT) Number of Items	f	NR (NOT REACHED) Number of Items	f
					14	1		
					13	-		
					12	-		
133	24- 25	133	24- 25	1	11	1	22- 23	1
234	22- 23	294	22- 23	5	10	8	20- 21	-
343	20- 21	358	20- 21	17	9	10	18- 19	-
250	18- 19	295	18- 19	33	8	8	16- 17	-
235	16- 17	245	16- 17	54	7	29	14- 15	4
199	14- 15	200	14- 15	62	6	24	12- 13	5
143	12- 13	159	12- 13	71	5	56	10- 11	13
122	10- 11	105	10- 11	89	4	83	8- 9	49
103	8- 9	85	8- 9	131	3	135	6- 7	82
59	6- 7	47	6- 7	198	2	218	4- 5	225
67	4- 5	24	4- 5	260	1	340	2- 3	163
25	2- 3	6	2- 3	466	0	1042	0- 1	1413
24	0- 1	4	0- 1	568				
15								
1								
2								
1955	1955		1955		1955		1955	
MEAN 16.19	17.30		4.98		1.23		1.49	
STANDARD DEVIATION 5.96	4.92		4.95		1.88		2.47	

R=.25Cla

4. Letter Groups

TEST National Longitudinal Study SUBJECT Mathematics FORM UEE

SECTION 5 ITEMS 25 (4-choice)

RAW SCORE	1 TO 2	3 TO 4	5 TO 6	7 TO 8	9 TO 10	11 TO 12	13 TO 14	15 TO 16	17 TO 18	19 TO 20	21 TO 22	23 TO 24	25 TO	TO	TO	TO	TO	SCORE f	R (RIGHT) Number of items	R f	W (WRONG) Number of items	W f	O (OMIT) Number of items	O f	NR (NOT REACHED) Number of items	NR f
24- 25													156					156								
22- 23												1	4	93				98								
20- 21											1	1	22	198				222								
18- 19										1	13	16	77					107	24- 25	156						
16- 17									1	6	13	29	165					214	22- 23	197	22- 23	3			22- 23	1
14- 15								1	4	3	17	22	73					120	20- 21	214	20- 21	38	20- 21	1	20- 21	-
12- 13									7	10	18	19	139					193	18- 19	221	18- 19	85	18- 19	-	18- 19	1
10- 11							1	1	4	6	14	16	80					122	16- 17	158	16- 17	124	16- 17	1	16- 17	2
8- 9						3	3	2	10	2	8	20	134					182	14- 15	220	14- 15	163	14- 15	-	14- 15	1
6- 7						2	4	4	5	9	2	18	67					118	12- 13	186	12- 13	174	12- 13	1	12- 13	5
4- 5				1	1	1	4	8	7	6	18	106						154	10- 11	178	10- 11	208	10- 11	2	10- 11	11
2- 3		2		2	1	2	5	4	5	8	13	9	55					106	8- 9	174	8- 9	207	8- 9	7	8- 9	40
0- 1	2			2		1	2	2	7	5	3	6	75					107	6- 7	126	6- 7	255	6- 7	15	6- 7	26
-2- -1							1	1	2	3	1	6	27					41	4- 5	70	4- 5	260	4- 5	31	4- 5	63
-4- -3									1			5	8					14	2- 3	13	2- 3	248	2- 3	90	2- 3	111
-6- -5													1					1	0- 1	2	0- 1	170	0- 1	1807	0- 1	1694
TOTAL	2	4	-	5	2	8	17	19	54	61	119	212	1454					1955	1955		1955		1955		1955	
MEAN																		12.53	15.38		9.55		0.38		0.70	
STANDARD DEVIATION																		7.47	5.80		5.40		1.28		2.09	

FORMULA ?=.3333W

5. Mathematics

Test: National Longitudinal Study — Subject: Mosaic Comparisons — Form: UEE

Test: 6, Part 1 — Item: 56 (3-choice)

Raw Score	1	5	9	13	17	21	25	29	33	37	41	45	49	53				Score	R (RIGHT)		W (WRONG)		O (OMIT)		NR (NOT REACHED)	
	4	8	12	16	20	24	28	32	36	40	44	48	52	56				f	Number of Items	f	Number of Items	f	Number of Items	f	Number of Items	f
55- 56														17				17					32- 33	1		
51- 54														2				2					30- 31	2		
47- 50												4	1					5	56	9			28- 29	-		
43- 46											2	1						3	52- 55	10	39- 41	2	26- 27	2	52- 55	4
39- 42										4	4	1						9	48- 51	1	36- 38	1	24- 25	-	48- 51	35
35- 38									12	12								24	44- 47	6	33- 35	1	22- 23	4	44- 47	135
31- 34								18	29	2								50	40- 43	9	30- 32	1	20- 21	-	40- 43	347
27- 30							67	63	5									135	36- 39	19	27- 29	1	18- 19	-	36- 39	458
23- 26						256	139	4										399	32- 35	46	24- 26	3	16- 17	-	32- 35	533
19- 22					202	250	14	3		1	1			1				472	28- 31	108	21- 23	1	14- 15	1	28- 31	225
15- 18				139	246	14		1	1					1				426	24- 27	327	18- 20	2	12- 13	1	24- 27	98
11- 14			63	164	12	3		2		1								249	20- 23	475	15- 17	7	10- 11	5	20- 23	48
7- 10		9	56	15	1	1	4							1				56	16- 19	463	12- 14	11	8- 9	5	16- 19	22
3- 6	4	16	8	6	2	3		1										37	12- 15	297	9- 11	13	6- 7	8	12- 15	7
-1- 2	4	12	8	4	1	4	1			1		1		1				37	8- 11	115	6- 8	22	4- 5	5	8- 11	13
-5- -2				2	2			1	1					2				8	4- 7	47	3- 5	81	2- 3	11	4- 7	1
-9- -6					1													1	0- 3	23	0- 2	1809	0- 1	1910	0- 3	29
TOTAL	5	36	137	354	487	530	225	44	49	21	7	7	1	25				1955	1955		1955		1955		1955	
																		MEAN	19.65		19.58		0.87		0.25	34.90
																		STANDARD DEVIATION	7.87		7.50		2.91		2.02	7.90

Score: 2-.5(.30)=

6. Mosaic Comparisons, Part 1

TEST: National Longitudinal Study — SUBTEST: Mosaic Comparisons — FORM: UEE

SECTION 6, Part 2 — ITEMS 33 (4-choice)

RAW SCORE	1 TO 2	3 TO 4	5 TO 6	7 TO 8	9 TO 10	11 TO 12	13 TO 14	15 TO 16	17 TO 18	19 TO 20	21 TO 22	23 TO 24	25 TO 26	27 TO 28	29 TO 30	31 TO 32	33 TO	SCORE	R (RIGHT)		W (WRONG)		O (OMIT)		NR (NOT REACHED)	
																		f	Number of items	f	Number of items	f	Number of items	f	Number of items	f
																			32- 33	15						
																			30- 31	5	30- 31	1			30- 31	1
																			26- 29	15	28- 29	-			28- 29	13
32- 33																2	13	15	26- 27	21	26- 27	5			26- 27	39
29- 31															7	1	3	11	24- 25	35	24- 25	2			24- 25	93
26- 28													14	12	1	2		29	22- 23	89	22- 23	1	22- 23	1	22- 23	141
23- 25												57	19	3				79	20- 21	130	20- 21	3	20- 21	-	20- 21	227
20- 22										55	41	21	3	1				171	18- 19	216	18- 19	5	18- 19	-	18- 19	370
17- 19									255	114	12	3		1			1	386	16- 17	388	16- 17	5	16- 17	1	16- 17	393
14- 16							113	339	99	20	5	3	1					567	14- 15	369	14- 15	9	14- 15	1	14- 15	279
11- 13						153	156	34	12			1	1		1			352	12- 13	256	12- 13	9	12- 13	-	12- 13	155
8- 10				28	48	31	21	6	2	1		1		1				179	10- 11	165	10- 11	10	10- 11	2	10- 11	99
5- 7			16	46	18	5	4	2	1	2	-	1	-	-	-	1	2	78	8- 9	115	8- 9	14	8- 9	2	8- 9	61
2- 4		3	1	9	4	4	4	4		3		4	1					37	6- 7	62	6- 7	21	6- 7	4	6- 7	24
-1- 1	2	4	2	7	3	2	1	4	2	4			2	1			1	35	4- 5	40	4- 5	39	4- 5	3	4- 5	20
-4- -2					2	2	1		1	1	1		1		1		5	15	2- 3	24	2- 3	223	2- 3	20	2- 3	6
-7- -5										1							1	2	0- 1	16	0- 1	1604	0- 1	1921	0- 1	34
TOTAL	2	7	19	70	115	191	497	389	362	201	109	91	41	19	10	6	26	1955	1955		1955		1955		1955	

r = .3330

	SCORE	R	W	O	NR
MEAN	14.74	15.07	1.11	0.12	16.70
STANDARD DEVIATION	5.55	5.12	2.90	0.94	4.99

6. Mosaic Comparisons, Part 2

TEST National Longitudinal Study

SUBJECT Mosaic Comparisons

FORM UEE

SECTION 6, Part 3

ITEMS 27 (5-choice)

RAW SCORE	1 to 2	3 to 4	5 to 6	7 to 8	9 to 10	11 to 12	13 to 14	15 to 16	17 to 18	19 to 20	21 to 22	23 to 24	25 to 26	27	TO	TO	TO	SCORE f
27														9				9
25- 26													5	5				10
23- 24												3		1				4
21- 22											16	2	1	2				21
19- 20										45	7		1					53
17- 18									91	18	2	1		2				114
15- 16								126	29	5		1						161
13- 14							253	50	10	2								315
11- 12						227	55	13	3	2			1	1				302
9- 10					276	73	23	10	2									384
7- 8				160	106	15	17	3	1	1		1		1				303
5- 6			65	27	24	8	4	6	2	2	—	1	1	2				142
3- 4		14	19	8	4	2	4	5	3	2		1	1	1				70
1- 2	1	1	7	8		2	3	4	2		2	1	1	4				35
-1- 0	1	1	4	1	2	2	3	2		4				5				25
-3- -2					1				1		2			1				5
-5- -4												1		1				2
TOTAL	1	15	44	204	423	327	382	219	144	81	29	12	11	35				1955

	R (RIGHT)		W (WRONG)		O (OMIT)		NR (NOT REACHED)	
	Number of items	f	Number of items	f	Number of items	f	Number of items	f
	26- 27	14	26- 27	1			26- 27	1
	24- 25	7	24- 25	-			24- 25	1
	22- 23	12	22- 23	7			22- 23	45
	20- 21	28	20- 21	5			20- 21	130
	18- 19	88	18- 19	5	18- 19	1	18- 19	343
	16- 17	136	16- 17	11	16- 17	1	16- 17	359
	14- 15	245	14- 15	3	14- 15	-	14- 15	323
	12- 13	307	12- 13	10	12- 13	-	12- 13	336
	10- 11	351	10- 11	20	10- 11	-	10- 11	180
	8- 9	403	8- 9	15	8- 9	4	8- 9	105
	6- 7	211	6- 7	30	6- 7	2	6- 7	55
	4- 5	109	4- 5	78	4- 5	2	4- 5	19
	2- 3	32	2- 3	266	2- 3	25	2- 3	10
	0- 1	12	0- 1	1504	0- 1	1920	0- 1	45
	1955		1955		1955		1955	
MEAN	11.11		1.36		0.13		14.40	
STANDARD DEVIATION	4.32		3.00		0.80		4.45	

R=.2500

6. Mosaic Comparisons, Part 3

Test National Longitudinal Study Subject _____ Form UEE

Frequency Distributions of Original Deltas and Biserial Correlations, by Sections

Delta	Section									
	1		3		4		5			
19.0 up ..										
18.0-18.9										
17.0-17.9										
16.0-16.9			1		1					
15.0-15.9	1		-		-					
14.0-14.9	4		2		1		1			
13.0-13.9	3		5		-		4			
12.0-12.9	4		4		2		9			
11.0-11.9	-		1		6		2			
10.0-10.9	1		3		5		6			
9.0- 9.9	1		3		3		3			
8.0- 8.9	1		1		2					
7.0- 7.9					4					
6.0- 6.9					1					
Total	15		20		25		25			
Mean	12.8		12.1		10.4		11.7			
σ	2.0		2.0		2.1		1.4			
a										
b										

Standard Δ = a(original Δ) + b

r_{bis}										
.90-.99										
.80-.89										
.70-.79	5				9		5			
.60-.69	6		9		9		11			
.50-.59	2		9		6		7			
.40-.49	1		2		1		1			
.30-.39	1						1			
.20-.29										
.10-.19										
.00-.09										
Negative .										
Total	15		20		25		25			
Not Comp.										
Mean	.63		.58		.65		.61			
σ	.10		.07		.08		.09			

APPENDIX D

Item P-Values

TABLE D-1

ITEM P-VALUES BY GROUP
VOCABULARY

ITEM	AI	AA	MA	PR	OL	OR	WE	WC	WS	WW	ITEM MEAN	ITEM S.D.
I- 1	.747	.714	.715	.823	.757	.881	.924	.914	.904	.915	.829	.084
I- 2	.315	.330	.349	.266	.561	.563	.590	.503	.505	.621	.460	.125
I- 3	551	.477	.551	.595	.579	.790	.836	.800	.759	.810	.675	.129
I- 4	.388	.344	.420	.582	.617	.670	.758	.651	.563	.702	.569	.134
I- 5	.674	.655	.578	.633	.589	.790	.868	.865	.871	.872	.739	.119
I- 6	.472	.408	.445	.468	.505	.523	.599	.581	.566	.570	.514	.061
I- 7	.354	.314	.304	.266	.327	.574	.666	.592	.542	.638	.458	.149
I- 8	.264	.189	.198	.139	.243	.392	.420	.403	.360	.385	.299	.099
I- 9	.326	.244	.308	.215	.364	.403	.510	.478	.441	.530	.382	.103
I-10	.331	.246	.233	.266	.262	.438	.514	.486	.468	.519	.376	.113
I-11	.225	.162	.184	.076	.178	.375	.435	.378	.313	.396	.272	.116
I-12	.157	.155	.147	.139	.140	.313	.381	.325	.301	.317	.238	.092
I-13	.287	.216	.249	.228	.355	.341	.350	.317	.322	.338	.300	.050
I-14	.270	.207	.257	.190	.346	.273	.378	.299	.314	.313	.285	.055
I-15	.264	.158	.216	.241	.327	.392	.506	.401	.395	.455	.335	.107
GROUP MEAN	.375	.321	.344	.342	.410	.514	.582	.533	.508	.559		
S.D.	.1613	.1695	.1602	.2139	.1742	.1849	.1826	.1925	.1919	.1927		

TABLE D-2

ITEM P-VALUES BY GROUP

PICTURE-NUMBER

ITEM	AI	AA	MA	PR	OL	OR	WE	WC	WS	WW	ITEM MEAN	ITEM S.D.
I- 1	.596	.593	.651	.595	.589	.693	.711	.676	.697	.664	.646	.046
I- 2	.685	.592	.688	.671	.701	.778	.769	.774	.778	.750	.719	.059
I- 3	.758	.688	.769	.759	.757	.773	.803	.792	.806	.790	.769	.032
I- 4	.607	.523	.633	.570	.617	.642	.703	.694	.697	.672	.636	.056
I- 5	.360	.320	.427	.266	.430	.466	.476	.476	.504	.432	.416	.073
I- 6	.399	.327	.408	.304	.374	.483	.476	.470	.482	.442	.416	.062
I- 7	.612	.516	.629	.557	.664	.688	.740	.719	.736	.695	.655	.072
I- 8	.506	.420	.557	.430	.523	.659	.600	.604	.622	.590	.551	.076
I- 9	.472	.344	.445	.392	.336	.517	.506	.530	.522	.511	.458	.071
I-10	.416	.329	.422	.329	.336	.483	.520	.512	.525	.463	.434	.075
I-11	.449	.338	.422	.354	.458	.580	.551	.535	.528	.497	.471	.078
I-12	.382	.276	.357	.291	.355	.455	.484	.481	.485	.442	.401	.076
I-13	.483	.328	.431	.342	.449	.659	.608	.596	.574	.559	.503	.108
I-14	.416	.353	.427	.392	.430	.619	.575	.557	.549	.522	.484	.086
I-15	.326	.255	.355	.241	.383	.551	.502	.514	.495	.476	.410	.107
I-16	.697	.670	.659	.696	.692	.778	.746	.741	.759	.720	.716	.037
I-17	.607	.491	.567	.468	.570	.608	.673	.640	.665	.619	.591	.065
I-18	.882	.819	.851	.886	.869	.886	.901	.873	.883	.874	.872	.022
I-19	.489	.488	.512	.443	.486	.631	.614	.596	.617	.573	.545	.065
I-20	.551	.458	.502	.354	.458	.551	.570	.544	.585	.522	.510	.066
I-21	.545	.515	.588	.481	.551	.653	.640	.666	.654	.609	.590	.061
I-22	.590	.511	.551	.456	.579	.676	.658	.647	.661	.609	.594	.068
I-23	.517	.405	.492	.291	.467	.642	.573	.599	.605	.547	.514	.100
I-24	.669	.539	.655	.557	.607	.739	.739	.728	.729	.701	.666	.071
I-25	.292	.249	.324	.165	.299	.358	.380	.373	.393	.355	.319	.067
I-26	.534	.400	.531	.430	.533	.608	.607	.610	.609	.601	.546	.073
I-27	.433	.319	.402	.253	.411	.540	.538	.537	.534	.495	.446	.096
I-28	.421	.340	.443	.228	.430	.523	.536	.543	.522	.508	.449	.096
I-29	.466	.350	.478	.342	.336	.489	.585	.568	.572	.525	.471	.092
I-30	.500	.406	.494	.367	.514	.625	.618	.595	.595	.558	.527	.084
GROUP MEAN	.522	.439	.522	.430	.507	.612	.613	.606	.613	.577		
S.D.	.1298	.1362	.1247	.1667	.1360	.1136	.1124	.1078	.1099	.1150		

TABLE D-3

ITEM P-VALUES BY GROUP

READING

ITEM	AI	AA	MA	PR	OL	OR	WE	WC	WS	WW	ITEM MEAN	ITEM S.D.
I- 1	.680	.688	.688	.684	.682	.801	.873	.853	.846	.849	.764	.082
I- 2	.551	.622	.663	.646	.589	.744	.792	.758	.763	.784	.691	.083
I- 3	.736	.768	.784	.785	.738	.915	.902	.885	.894	.872	.828	.068
I- 4	.579	.595	.539	.532	.551	.716	.739	.699	.702	.705	.636	.079
I- 5	.494	.592	.543	.608	.589	.750	.741	.720	.736	.733	.650	.091
I- 6	.640	.560	.610	.633	.626	.835	.812	.804	.809	.815	.715	.103
I- 7	.348	.257	.333	.291	.346	.523	.549	.536	.513	.538	.423	.112
I- 8	.376	.301	.363	.278	.393	.670	.631	.599	.593	.607	.481	.144
I- 9	.410	.381	.292	.291	.355	.523	.620	.577	.562	.538	.455	.117
I-10	.455	.415	.398	.430	.411	.619	.627	.597	.597	.633	.518	.098
I-11	.371	.303	.304	.329	.336	.545	.564	.505	.500	.530	.429	.103
I-12	.702	.674	.708	.671	.701	.824	.864	.834	.848	.837	.766	.077
I-13	.427	.338	.412	.354	.374	.574	.648	.648	.634	.669	.508	.131
I-14	.208	.175	.184	.266	.159	.330	.374	.314	.311	.353	.267	.076
I-15	.146	.137	.147	.215	.215	.182	.238	.227	.256	.243	.201	.042
I-16	.348	.265	.257	.253	.252	.432	.506	.528	.525	.554	.392	.123
I-17	.309	.240	.271	.291	.280	.403	.376	.343	.353	.377	.324	.051
I-18	.528	.353	.429	.304	.421	.676	.695	.682	.677	.684	.545	.148
I-19	.275	.179	.229	.165	.243	.369	.432	.392	.377	.401	.306	.094
I-20	.275	.165	.216	.152	.187	.398	.449	.442	.431	.458	.317	.123
GROUP												
MEAN	.443	.400	.418	.409	.422	.591	.622	.597	.596	.609		
S.D.	.1635	.1945	.1884	.1915	.1773	.1918	.1812	.1835	.1845	.1767		

TABLE D-4

ITEM P-VALUES BY GROUP

LETTER GROUPS

ITEM	AI	AA	MA	PR	OL	OR	ME	MC	MS	MW	ITEM MEAN	ITEM S.D.
I- 1	.826	.802	.808	.848	.766	.920	.918	.926	.902	.919	.864	.057
I- 2	.466	.494	.502	.456	.533	.659	.708	.664	.649	.656	.579	.092
I- 3	.837	.752	.771	.722	.776	.903	.903	.885	.869	.877	.830	.065
I- 4	.910	.829	.849	.873	.879	.943	.957	.948	.954	.952	.909	.046
I- 5	.449	.441	.518	.494	.570	.744	.766	.734	.705	.744	.616	.127
I- 6	.837	.807	.837	.835	.822	.943	.934	.932	.931	.922	.880	.053
I- 7	.517	.536	.580	.633	.570	.807	.771	.741	.716	.752	.662	.102
I- 8	.556	.470	.527	.468	.570	.716	.754	.737	.657	.682	.614	.103
I- 9	.511	.457	.500	.481	.430	.727	.710	.700	.670	.697	.588	.115
I-10	.685	.719	.747	.722	.720	.869	.876	.866	.860	.850	.791	.075
I-11	.635	.600	.620	.582	.533	.761	.810	.798	.773	.812	.692	.103
I-12	.899	.827	.853	.848	.841	.955	.952	.947	.936	.933	.899	.049
I-13	.820	.799	.816	.835	.785	.955	.916	.913	.900	.908	.865	.057
I-14	.522	.486	.571	.468	.505	.778	.776	.739	.731	.744	.632	.125
I-15	.713	.575	.698	.658	.654	.881	.832	.831	.802	.832	.748	.096
I-16	.618	.557	.598	.468	.617	.858	.848	.819	.795	.817	.699	.135
I-17	.652	.536	.586	.582	.617	.818	.838	.821	.801	.806	.706	.115
I-18	.494	.506	.539	.405	.523	.716	.681	.678	.626	.633	.580	.096
I-19	.393	.342	.382	.266	.318	.580	.543	.555	.534	.546	.446	.111
I-20	.624	.510	.571	.367	.533	.847	.805	.803	.776	.785	.662	.155
I-21	.461	.327	.376	.278	.430	.693	.649	.625	.607	.612	.506	.141
I-22	.270	.180	.212	.127	.196	.375	.358	.354	.322	.324	.272	.083
I-23	.174	.093	.116	.076	.093	.239	.226	.214	.181	.231	.164	.061
I-24	.433	.255	.322	.203	.346	.568	.535	.539	.492	.497	.419	.123
I-25	.303	.200	.198	.101	.215	.426	.392	.416	.349	.348	.295	.105
GROUP MEAN	.584	.524	.564	.512	.554	.747	.738	.728	.702	.715		
S.D.	.1959	.2085	.2059	.2417	.2043	.1850	.1903	.1875	.1976	.1939		

TABLE D-5

ITEM P-VALUES BY GROUP
MATHEMATICS

ITEM	AI	AA	MA	PR	OL	OR	WE	WC	WS	WW	ITEM MEAN	ITEM S.D.
I- 1	.702	.647	.641	.696	.673	.881	.868	.868	.850	.836	.766	.097
I- 2	.725	.679	.718	.684	.757	.824	.790	.761	.766	.753	.746	.043
I- 3	.730	.663	.733	.671	.729	.852	.872	.855	.863	.850	.782	.080
I- 4	.702	.653	.722	.671	.710	.830	.836	.848	.833	.855	.766	.077
I- 5	.416	.459	.508	.430	.514	.852	.765	.747	.755	.742	.619	.159
I- 6	.640	.560	.569	.595	.561	.710	.807	.830	.782	.782	.684	.105
I- 7	.669	.553	.563	.544	.589	.813	.808	.803	.768	.782	.689	.111
I- 8	.449	.364	.410	.418	.421	.750	.656	.635	.629	.623	.536	.129
I- 9	.607	.562	.616	.481	.598	.767	.782	.763	.751	.745	.667	.101
I-10	.466	.373	.431	.354	.421	.773	.645	.627	.635	.620	.535	.135
I-11	.494	.350	.420	.354	.467	.580	.637	.629	.611	.605	.515	.107
I-12	.461	.529	.561	.519	.523	.835	.740	.718	.713	.726	.633	.121
I-13	.461	.395	.467	.329	.514	.795	.705	.680	.659	.655	.566	.145
I-14	.567	.400	.527	.468	.589	.744	.723	.719	.685	.711	.613	.115
I-15	.416	.395	.355	.380	.327	.653	.602	.599	.573	.567	.487	.116
I-16	.309	.301	.394	.329	.402	.767	.617	.574	.609	.563	.486	.152
I-17	.427	.400	.437	.291	.477	.784	.650	.622	.629	.613	.533	.141
I-18	.388	.329	.343	.278	.299	.563	.587	.576	.542	.552	.446	.122
I-19	.393	.362	.406	.304	.505	.670	.579	.580	.551	.544	.489	.111
I-20	.382	.304	.347	.266	.355	.619	.646	.640	.613	.608	.478	.150
I-21	.275	.195	.290	.203	.355	.676	.545	.517	.503	.463	.402	.154
I-22	.270	.205	.263	.228	.336	.642	.534	.525	.486	.506	.399	.148
I-23	.253	.199	.218	.177	.215	.523	.447	.418	.413	.404	.327	.120
I-24	.247	.181	.243	.127	.234	.449	.471	.460	.439	.433	.328	.127
I-25	.264	.243	.286	.228	.271	.557	.470	.438	.421	.389	.357	.107
GROUP MEAN	.469	.412	.459	.401	.474	.716	.671	.657	.643	.637		
S.D.	.1562	.1532	.1497	.1663	.1514	.1153	.1232	.1292	.1302	.1354		

TABLE D-6

ITEM P-VALUES BY GROUP
MOSAIC COMPARISONS

ITEM	AI	AA	MA	PR	OL	OR	WE	WC	WS	WW	ITEM MEAN	ITEM S.D.
I- 1	.910	.838	.904	.873	.879	.943	.941	.943	.938	.948	.912	.036
I- 2	.904	.848	.900	.899	.907	.972	.943	.946	.947	.943	.921	.034
I- 3	.854	.822	.871	.823	.869	.898	.920	.932	.918	.922	.883	.039
I- 4	.848	.795	.851	.848	.822	.926	.927	.931	.916	.929	.879	.049
I- 5	.910	.834	.890	.873	.897	.943	.944	.953	.944	.952	.914	.038
I- 6	.910	.828	.896	.861	.841	.960	.944	.953	.941	.945	.908	.047
I- 7	.904	.830	.900	.899	.822	.972	.951	.959	.948	.956	.914	.051
I- 8	.882	.767	.841	.823	.850	.932	.927	.944	.928	.927	.882	.056
I- 9	.848	.713	.814	.734	.794	.943	.908	.917	.895	.907	.847	.076
I-10	.826	.637	.769	.671	.813	.903	.864	.888	.866	.868	.811	.087
I-11	.781	.580	.761	.557	.720	.881	.860	.887	.855	.859	.774	.115
I-12	.736	.514	.682	.468	.645	.886	.817	.846	.810	.811	.722	.135
I-13	.719	.483	.647	.418	.579	.858	.781	.814	.773	.791	.686	.142
I-14	.640	.403	.557	.392	.486	.818	.706	.747	.703	.717	.617	.141
I-15	.522	.307	.473	.316	.421	.744	.620	.660	.618	.653	.534	.143
I-16	.427	.246	.380	.253	.346	.670	.512	.555	.520	.538	.445	.131
I-17	.360	.207	.337	.190	.271	.585	.437	.470	.448	.467	.377	.121
I-18	.303	.143	.220	.063	.196	.489	.308	.359	.324	.346	.275	.116
I-19	.213	.122	.157	.051	.159	.432	.237	.265	.263	.272	.217	.099
I-20	.180	.095	.131	.051	.112	.341	.179	.204	.210	.209	.171	.077
GROUP MEAN	.684	.551	.649	.553	.621	.805	.736	.759	.738	.748		
S.D.	.2476	.2718	.2642	.3076	.2699	.1905	.2541	.2442	.2444	.2415		

APPENDIX E

Item Deltas

TABLE E-1

ITEM DELTAS BY GROUP
VOCABULARY

ITEM	AI	AA	MA	PR	OL	OR	WE	WC	WS	WW	ITEM MEAN	ITEM S.D.
I- 1	10.34	10.74	10.73	9.30	10.21	8.29	7.28	7.52	7.77	7.50	8.97	1.37
I- 2	14.93	14.76	14.55	15.50	12.39	12.37	12.09	12.97	12.95	11.77	13.43	1.29
I- 3	12.49	13.23	12.49	12.04	12.20	9.78	9.09	9.64	10.19	9.49	11.06	1.48
I- 4	14.14	14.60	13.80	12.17	11.81	11.24	10.20	11.45	12.37	10.88	12.27	1.39
I- 5	11.20	11.41	12.22	11.04	12.10	9.78	8.52	8.59	8.48	8.45	10.24	1.54
I- 6	13.28	13.93	13.55	13.32	12.95	12.77	12.00	12.18	12.33	12.30	12.86	0.62
I- 7	14.50	14.93	15.05	15.50	14.79	12.26	11.29	12.07	12.58	11.58	13.45	1.55
I- 8	15.52	16.53	16.40	17.34	15.79	14.09	13.80	13.98	14.43	14.17	15.20	1.21
I- 9	14.80	15.77	15.00	16.15	14.38	13.98	12.90	13.22	13.59	12.70	14.25	1.12
I-10	14.74	15.74	15.92	15.50	15.55	13.63	12.86	13.14	13.32	12.81	14.32	1.22
I-11	16.02	16.95	16.61	18.73	16.70	14.27	13.65	14.24	14.95	14.05	15.62	1.56
I-12	17.02	17.06	17.20	17.34	17.32	14.95	14.20	14.82	15.08	14.91	15.99	1.22
I-13	15.25	16.15	15.71	15.98	14.48	14.64	14.54	14.91	14.84	14.67	15.12	0.59
I-14	15.45	16.27	15.61	16.51	14.59	15.42	14.24	15.11	14.93	14.95	15.31	0.67
I-15	15.52	17.01	16.14	15.82	14.79	14.09	12.94	14.00	14.07	13.45	14.78	1.23
GROUP MEAN	14.35	15.01	14.73	14.86	14.00	12.77	11.97	12.52	12.79	12.25		
S.D.	1.753	1.898	1.776	2.502	1.923	2.066	2.180	2.254	2.235	2.254		

***** ITEM DELTAS COMPUTED ONLY IF (1) $.05 \leq P \leq .95$
AND (2) MORE THAN 50% OF THE GROUP RESPONDED TO THE ITEM

TABLE E-2

ITEM DELTAS BY GROUP
PICTURE-NUMBER

ITEM	AI	AA	MA	PR	OL	OR	ME	MC	MS	MW	ITEM MEAN	ITEM S.D.
I- 1	12.03	12.06	11.45	12.04	12.10	10.98	10.78	11.18	10.94	11.31	11.49	0.50
I- 2	11.07	12.07	11.04	11.23	10.89	9.93	10.05	9.99	9.94	10.30	10.65	0.68
I- 3	10.20	11.05	10.05	10.18	10.21	10.01	9.60	9.75	9.55	9.78	10.04	0.41
I- 4	11.92	12.77	11.65	12.30	11.81	11.55	10.87	10.97	10.93	11.22	11.60	0.59
I- 5	14.44	14.87	13.74	15.50	13.71	13.34	13.24	13.24	12.96	13.69	13.87	0.77
I- 6	14.02	14.80	13.93	15.05	14.29	13.17	13.24	13.30	13.18	13.58	13.86	0.65
I- 7	11.86	12.84	11.69	12.43	11.31	11.05	10.43	10.69	10.48	10.96	11.37	0.78
I- 8	12.94	13.81	12.43	13.70	12.77	11.36	11.99	11.94	11.76	12.09	12.48	0.77
I- 9	13.28	*****	13.55	14.09	14.69	12.83	12.94	12.70	12.78	12.89	13.31	0.65
I-10	13.85	*****	13.78	*****	14.69	13.17	12.80	12.88	12.75	13.37	13.41	0.62
I-11	13.51	*****	13.78	*****	13.42	12.20	12.49	12.65	12.72	13.03	12.98	0.52
I-12	14.20	*****	*****	*****	*****	13.46	13.16	13.19	13.15	13.58	13.46	0.37
I-13	13.17	*****	*****	*****	13.52	11.36	11.91	12.03	12.25	12.41	12.38	0.69
I-14	*****	*****	*****	*****	*****	11.79	12.25	12.43	12.51	12.78	12.35	0.33
I-15	*****	*****	*****	*****	*****	12.49	12.98	12.86	13.05	13.24	12.92	0.25
I-16	10.94	11.25	11.36	10.95	11.00	9.93	10.36	10.42	10.20	10.67	10.71	0.45
I-17	11.92	13.09	12.32	13.32	12.29	11.91	11.21	11.57	11.30	11.79	12.07	0.67
I-18	8.26	9.36	8.84	8.18	8.51	8.17	7.86	8.44	8.24	8.41	8.43	0.39
I-19	13.11	13.12	12.88	13.57	13.14	11.67	11.84	12.03	11.82	12.27	12.54	0.66
I-20	12.49	13.42	12.98	14.49	13.42	12.49	12.29	12.55	12.15	12.78	12.91	0.67
I-21	12.55	12.85	12.11	13.19	12.48	11.42	11.57	11.29	11.42	11.89	12.08	0.63
I-22	12.09	12.89	12.49	13.44	12.20	11.17	11.37	11.50	11.34	11.90	12.04	0.70
I-23	12.83	13.96	13.08	15.20	13.33	11.55	12.26	11.99	11.94	12.53	12.87	1.04
I-24	11.26	12.61	11.41	12.43	11.91	10.44	10.44	10.58	10.57	10.90	11.25	0.78
I-25	15.19	15.71	14.82	*****	15.11	14.45	14.22	14.29	14.09	14.48	14.71	0.51
I-26	12.66	14.02	12.69	13.70	12.67	11.91	11.91	11.88	11.90	11.98	12.53	0.74
I-27	13.68	*****	13.99	*****	13.90	12.60	12.62	12.62	12.66	13.05	13.14	0.57
I-28	13.79	*****	13.57	*****	13.71	12.77	12.64	12.57	12.78	12.92	13.09	0.47
I-29	13.34	*****	13.22	14.63	14.69	13.11	12.15	12.31	12.28	12.75	13.16	0.90
I-30	13.00	*****	13.06	*****	12.86	11.73	11.80	12.04	12.04	12.42	12.37	0.51
GROUP MEAN	12.63	12.97	12.54	12.98	12.76	11.80	11.78	11.86	11.79	12.17		
S.D.	1.403	1.434	1.315	1.783	1.489	1.277	1.290	1.207	1.246	1.275		

***** ITEM DELTAS COMPUTED ONLY IF (1) $.05 \leq P \leq .95$
AND (2) MORE THAN 50% OF THE GROUP RESPONDED TO THE ITEM

TABLE E-3
ITEM DELTAS BY GROUP
READING

ITEM	AI	AA	MA	PR	OL	OR	WE	WC	WS	WW	ITEM MEAN	ITEM S.D.
I- 1	11.13	11.05	11.04	11.09	11.11	9.62	8.44	8.80	8.92	8.87	10.01	1.11
I- 2	12.49	11.76	11.32	11.91	12.10	10.37	9.74	10.20	10.14	9.86	10.95	0.95
I- 3	10.48	10.07	9.86	9.85	10.45	7.52	7.83	8.20	8.01	8.46	9.07	1.11
I- 4	12.21	12.04	12.61	12.68	12.48	10.72	10.44	10.92	10.88	10.84	11.58	0.85
I- 5	13.06	12.07	12.57	11.91	12.10	10.30	10.42	10.68	10.48	10.52	11.41	0.98
I- 6	11.56	12.40	11.88	11.64	11.71	9.10	9.47	9.57	9.50	9.41	10.63	1.24
I- 7	14.56	15.61	14.73	15.20	14.59	12.77	12.51	12.64	12.87	12.62	13.81	1.17
I- 8	14.26	15.08	14.40	15.35	14.09	11.24	11.67	12.00	12.06	11.92	13.21	1.49
I- 9	13.91	14.21	15.19	15.20	14.48	12.77	11.78	12.22	12.38	12.62	13.48	1.20
I-10	13.45	13.85	14.03	13.70	13.90	11.79	11.70	12.02	12.02	11.64	12.81	0.99
I-11	14.32	15.06	15.05	14.77	14.69	12.54	12.36	12.95	13.00	12.70	13.74	1.07
I-12	10.88	11.20	10.81	11.23	10.89	9.28	8.60	9.13	8.89	9.08	10.00	1.03
I-13	13.73	14.67	13.89	14.49	14.29	12.26	11.48	11.48	11.64	11.25	12.92	1.34
I-14	16.25	16.73	16.61	15.50	17.00	14.76	14.28	14.94	14.97	14.51	15.55	0.96
I-15	17.21	17.37	17.20	16.15	16.16	16.63	15.85	15.99	15.63	15.78	16.40	0.62
I-16	14.56	15.51	15.61	15.66	15.67	13.69	12.94	12.72	12.75	12.46	14.16	1.31
I-17	14.99	15.82	15.43	15.20	15.33	13.98	14.26	14.62	14.51	14.25	14.84	0.57
I-18	12.72	14.51	13.72	15.05	13.80	11.17	10.97	11.10	11.17	11.08	12.53	1.54
I-19	15.39	16.67	15.97	16.90	15.79	14.33	13.68	14.10	14.25	14.00	15.11	1.12
I-20	15.39	16.90	16.14	17.11	16.56	14.04	13.51	13.58	13.69	13.42	15.03	1.46
GROUP MEAN	13.63	14.13	13.90	14.01	13.86	11.94	11.60	11.89	11.89	11.76		
S.D.	1.774	2.150	2.061	2.087	1.924	2.202	2.097	2.074	2.093	1.990		

***** ITEM DELTAS COMPUTED ONLY IF (1) .05 ≤ P ≤ .95
AND (2) MORE THAN 50% OF THE GROUP RESPONDED TO THE ITEM

TABLE E-4
ITEM DELTAS BY GROUP
LETTER GROUPS

ITEM	AI	AA	MA	PR	OL	OR	WE	WC	WS	WW	ITEM MEAN	ITEM S.D.
I- 1	9.25	9.61	9.52	8.89	10.09	7.37	7.42	7.20	7.82	7.40	8.46	1.06
I- 2	13.34	13.06	12.98	13.44	12.67	11.36	10.81	11.31	11.47	11.39	12.18	0.95
I- 3	9.07	10.28	10.03	10.65	9.97	7.79	7.81	8.19	8.52	8.35	9.07	1.03
I- 4	7.63	9.20	8.87	8.43	8.33	6.67	*****	6.48	*****	*****	7.95	0.98
I- 5	13.51	13.59	12.82	13.06	12.29	10.37	10.10	10.50	10.85	10.38	11.75	1.36
I- 6	9.07	9.54	9.08	9.10	9.30	6.67	6.98	7.03	7.06	7.31	8.11	1.12
I- 7	12.83	12.64	12.20	11.64	12.29	9.54	10.03	10.42	10.72	10.28	11.26	1.14
I- 8	12.44	13.30	12.73	13.32	12.29	10.72	10.25	10.47	11.39	11.11	11.80	1.10
I- 9	12.89	13.43	13.00	13.19	13.71	10.58	10.79	10.91	11.24	10.94	12.07	1.20
I-10	11.07	10.68	10.34	10.65	10.67	8.51	8.38	8.56	8.67	8.85	9.64	1.06
I-11	11.62	11.99	11.78	12.17	12.67	10.16	9.49	9.66	10.00	9.47	10.90	1.19
I-12	7.90	9.24	8.80	8.89	9.00	*****	*****	6.53	6.90	7.02	8.04	1.02
I-13	9.34	9.65	9.39	9.10	9.84	*****	7.48	7.55	7.87	7.68	8.66	0.93
I-14	12.78	13.14	12.28	13.32	12.95	9.93	9.97	10.44	10.54	10.38	11.57	1.36
I-15	10.75	12.24	10.93	11.37	11.41	8.29	9.15	9.17	9.60	9.15	10.21	1.23
I-16	11.80	12.43	12.01	13.32	11.81	8.72	8.89	9.35	9.70	9.38	10.74	1.60
I-17	11.44	12.64	12.14	12.17	11.81	9.37	9.05	9.33	9.62	9.54	10.71	1.37
I-18	13.06	12.94	12.61	13.96	12.77	10.72	11.11	11.15	11.71	11.64	12.17	0.99
I-19	14.08	14.62	14.20	15.50	14.89	12.20	12.57	12.45	12.66	12.53	13.57	1.15
I-20	11.74	12.90	12.28	14.36	12.67	8.91	9.57	9.58	9.97	9.84	11.18	1.74
I-21	13.39	14.79	14.27	15.35	13.71	10.98	11.47	11.73	11.92	11.86	12.95	1.46
I-22	15.45	16.67	16.19	*****	16.42	14.27	14.45	14.49	14.84	14.82	15.29	0.87
I-23	16.75	18.29	17.77	*****	18.28	15.84	16.01	16.17	16.64	15.94	16.86	0.95
I-24	13.68	15.63	14.84	*****	14.59	12.31	12.65	12.61	13.08	13.03	13.60	1.09
I-25	15.06	*****	16.40	*****	16.16	13.74	14.10	13.84	14.55	14.56	14.80	0.94
GROUP MEAN	12.00	12.60	12.30	11.99	12.42	10.22	10.37	10.20	10.72	10.54		
S.D.	2.290	2.321	2.360	2.137	2.367	2.307	2.292	2.423	2.397	2.350		

***** ITEM DELTAS COMPUTED ONLY IF (1) .05 ≤ P ≤ .95
AND (2) MORE THAN 50% OF THE GROUP RESPONDED TO THE ITEM

TABLE E-5

ITEM DELTAS BY GROUP

MATHEMATICS

ITEM	AI	AA	HA	PR	OL	OR	NE	NC	NS	NW	ITEM MEAN	ITEM S.D.
I- 1	10.88	11.49	11.56	10.95	11.21	8.29	8.52	8.52	8.86	9.09	9.94	1.31
I- 2	10.61	11.15	10.69	11.09	10.21	9.28	9.77	10.17	10.09	10.27	10.33	0.54
I- 3	10.55	11.32	10.52	11.23	10.56	8.82	8.45	8.77	8.63	8.86	9.77	1.10
I- 4	10.88	11.43	10.64	11.23	10.78	9.19	9.09	8.88	9.14	8.76	10.00	1.02
I- 5	13.85	13.41	12.92	13.70	12.86	8.82	10.11	10.35	10.24	10.41	11.67	1.76
I- 6	11.56	12.39	12.30	12.04	12.39	10.79	9.53	9.19	9.88	9.88	11.00	1.22
I- 7	11.26	12.47	12.36	12.56	12.10	9.45	9.51	9.59	10.07	9.89	10.93	1.28
I- 8	13.51	14.39	13.91	13.83	13.80	10.30	11.39	11.62	11.68	11.75	12.62	1.34
I- 9	11.92	12.37	11.82	13.19	12.01	10.08	9.89	10.14	10.29	10.36	11.21	1.12
I-10	13.34	14.30	13.70	14.49	13.80	10.01	11.51	11.69	11.63	11.78	12.62	1.41
I-11	13.06	14.54	13.80	14.49	13.33	12.20	11.60	11.68	11.87	11.93	12.85	1.09
I-12	13.39	12.71	12.38	12.81	12.77	9.10	10.43	10.69	10.76	10.60	11.56	1.34
I-13	13.39	14.07	13.33	14.77	12.86	9.70	10.84	11.13	11.36	11.40	12.29	1.54
I-14	12.32	14.01	12.73	13.32	12.10	10.37	10.64	10.68	11.07	10.78	11.80	1.21
I-15	13.85	14.07	14.48	14.22	14.79	11.42	11.97	11.99	12.27	12.33	13.14	1.19
I-16	14.99	15.09	14.08	14.77	13.99	10.08	11.81	12.25	11.90	12.36	13.13	1.60
I-17	13.73	14.01	13.64	15.20	13.23	9.86	11.46	11.76	11.69	11.85	12.64	1.50
I-18	14.14	14.77	14.62	15.35	15.11	12.37	12.13	12.23	12.58	12.48	13.58	1.26
I-19	14.08	14.42	13.95	15.05	12.95	11.24	12.21	12.20	12.49	12.55	13.11	1.14
I-20	14.20	15.05	14.57	15.50	14.48	11.79	11.50	11.57	11.85	11.90	13.24	1.56
I-21	15.39	16.44	15.21	16.33	14.48	11.17	12.55	12.83	12.97	13.37	14.08	1.67
I-22	15.45	16.29	15.53	15.98	14.69	11.55	12.66	12.75	13.14	12.94	14.10	1.59
I-23	15.66	16.38	16.11	16.70	16.16	12.77	13.53	13.83	13.88	13.97	14.90	1.36
I-24	15.73	16.04	15.79	17.57	15.91	13.51	13.29	13.40	13.61	13.68	14.91	1.50
I-25	15.52	15.78	15.26	15.98	15.44	12.43	13.30	13.62	13.79	14.13	14.53	1.16
GROUP MEAN	13.33	13.96	13.44	14.09	13.28	10.58	11.11	11.26	11.43	11.49		
S.D.	1.648	1.654	1.585	1.824	1.607	1.377	1.443	1.497	1.478	1.527		

***** ITEM DELTAS COMPUTED ONLY IF (1) .05 ≤ P ≤ .95
AND (2) MORE THAN 50% OF THE GROUP RESPONDED TO THE ITEM

TABLE E-6

ITEM DELTAS BY GROUP
MOSAIC COMPARISONS

ITEM	AI	AA	MA	PR	OL	OR	WE	WC	WS	WW	ITEM MEAN	ITEM S.D.
I- 1	7.63	9.05	7.78	8.43	8.33	6.67	6.75	6.69	6.84	6.48	7.46	0.86
I- 2	7.77	8.88	7.87	7.90	7.72	*****	6.67	6.56	6.52	6.67	7.40	0.78
I- 3	8.79	9.31	8.47	9.30	8.51	7.92	7.37	7.04	7.43	7.31	8.15	0.80
I- 4	8.88	9.70	8.84	8.89	9.30	7.21	7.18	7.07	7.48	7.13	8.17	0.99
I- 5	7.63	9.13	8.10	8.43	7.94	6.67	6.63	*****	6.65	*****	7.65	0.87
I- 6	7.63	9.21	7.96	8.66	9.00	*****	6.63	*****	6.76	6.61	7.81	1.01
I- 7	7.77	9.19	7.87	7.90	9.30	*****	*****	*****	6.49	*****	8.09	0.95
I- 8	8.26	10.08	9.01	9.30	8.85	7.04	7.17	6.65	7.15	7.18	8.07	1.12
I- 9	8.88	10.75	9.43	10.50	9.71	6.67	7.68	7.47	7.99	7.71	8.68	1.31
I-10	9.25	11.60	10.05	11.23	9.44	7.79	8.61	8.13	8.56	8.54	9.32	1.22
I-11	9.90	12.20	10.16	12.43	10.67	8.29	8.67	8.17	8.77	8.70	9.80	1.48
I-12	10.48	12.86	11.11	13.32	11.52	8.17	9.39	8.92	9.49	9.47	10.47	1.62
I-13	10.68	13.17	11.49	*****	12.20	8.72	9.90	9.42	10.00	9.76	10.59	1.35
I-14	11.56	*****	12.43	*****	13.14	9.37	10.83	10.34	10.87	10.71	11.16	1.12
I-15	12.78	*****	13.27	*****	*****	10.37	11.78	11.35	11.80	11.43	11.83	0.88
I-16	*****	*****	*****	*****	*****	11.24	12.88	12.44	12.80	12.62	12.40	0.60
I-17	*****	*****	*****	*****	*****	12.14	*****	13.30	*****	*****	12.72	0.58
I-18	*****	*****	*****	*****	*****	13.11	*****	*****	*****	*****	13.11	0.0
I-19	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	0.0	0.0
I-20	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	0.0	0.0
GROUP MEAN	9.19	10.39	9.59	9.69	9.69	8.76	8.54	8.83	8.48	8.59		
S.D.	1.536	1.492	1.718	1.714	1.564	2.003	1.949	2.164	1.933	1.881		

***** ITEM DELTAS COMPUTED ONLY IF (1) $.05 \leq P \leq .95$
AND (2) MORE THAN 50% OF THE GROUP RESPONDED TO THE ITEM